

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. XL.

February 11, 1939

No. 1,024

Works Maintenance

FROM one point of view works maintenance is a disheartening subject. Everything under the sun is in a slow process of decay, and whatever steps may be taken to prevent the process, it must run to completion eventually. For chemical plant the pace of deterioration is comparatively rapid under the severe working conditions imposed by the handling of gaseous, liquid and solid chemicals often at high temperatures and pressures. As compared with the great majority of manufacturing industries, replacement of chemical equipment tends to recur with more frequent regularity and thus, on the grounds of economy alone, it is all the more necessary to postpone this operation as long as possible. Recent times have seen great technical developments in the chemical industry; not the least of these is the acceleration of manufacturing processes with a consequently increased strain on the plant. The maintenance of the plant in good working order is, therefore, becoming an even more essential part of a works' activities.

Like all other principal industrial activities, the keynote of successful and efficient works maintenance is to be found in organisation. Works maintenance should be organised and conducted according to a carefully planned programme. The details of the programme will differ, of course, from works to works, but all programmes would have certain general features in common. Regularity in inspection would be basic to any plan and it should be decided and laid down how often (whether daily, weekly or monthly, etc.), different plant units required examination. The maintenance records showing the date of examination, the condition of the plant at that time, the details of the work done (such as cleaning and oiling), and items of repair found necessary would give a valuable insight into the working of the plant, and they would also help to show when a plant unit reaches the stage when it is more economical to scrap it entirely rather than to continue repairing it.

Many works managers must have experienced a breakdown when plant was working to full capacity and time was all important. Such breakdowns can represent a severe financial loss, and they may also mean injury to personnel. In fact, the subjects of works maintenance and safety are inter-dependent to a certain extent. Greatest attention has always, very rightly, been paid to safe working con-

ditions in industry. But of the many aspects of safety which have come under consideration, the maintenance of the plant in thoroughly sound working order, lest a breakdown involving injury should occur, appears to have been little discussed. It may be that it has always been assumed that the plant itself, if properly handled by the employee according to instructions, cannot be held to be a source of danger, and that unfortunate accidents which do occur through an apparent fault in the plant itself are classified as "unforeseen." In some cases it must be admitted that the fault in the plant is in reality a dangerous condition which has been built up through lack of attention.

It is said that the most effective method of reducing accidents in industry is to imbue each and every employee with a sense of "safety-mindedness." On the same lines, would not "maintenance-minded" employees greatly assist not only in reducing accidents but in avoiding costly breakdowns? Maintenance-mindedness is really safety-mindedness carried a stage further. The safety-minded employee has been taught to tidy up all rubbish, to leave no obstruction in passages, to leave no tools lying about, and all the many small points which contribute to good house-keeping in the works. But the maintenance-minded man would not stop at that. He would cultivate the good-housekeeping outlook not only from the personal safety point of view, but also in the interests of the safety of the plant itself, by seeing that the plant was not subjected to any injury through controllable physical or chemical conditions. The employee is warned against the man who "slops about" the works and who can be a positive danger to himself and others; this type is also a danger to the satisfactory running of the plant. The maintenance-minded employee would constantly think of himself, others and the plant, and would regard the latter as almost human.

Some systematic form of works maintenance education for employees, perhaps as in extension of existing safety education arrangements, would surely lead to more economical working and an enhancement of general plant efficiency. It might be thought that this would be taking the matter too far, but maintenance costs should never be pared down for a serious breakdown might involve a loss totally incomensurate with the financial outlay on maintenance services.

Efficiency is often secured by complication of design or by more delicate construction, and such units necessarily involve more delicate control. There may be less unskilled labour, but certainly there will be more skilled attention. No unit can be considered automatic from the practical point of view, and it is only fair to a unit to allow for the proper skilled attention.

—G. Weyman.

NOTES AND COMMENTS

Political Inconsistencies

OUR politicians are a strange race. They will debate for whole sittings and even for days on end matters of popular controversy and of comparative unimportance. When, however, as happened last Monday, the Government invites the House of Commons to revolutionise the national currency policy, less than a dozen Members are sufficiently interested to speak and the house adjourns in time for dinner. The Currency and Bank Notes Bill, which had such an easy passage on its second reading, provides that the gold in the Issue Department of the Bank of England shall be valued at current value and not at the present figure of 85s. a fine ounce. The old arrangement has lasted for nearly a century, as it was embodied in Sir Robert Peel's memorable Bank Charter of 1844, and it goes by the board after three hours' debate. The irony of the position is emphasised by the fact that the third reading of the Export Guarantees Bill, which the orthodox economists of any other age would have handled severely for its departure from the principle that trade fares best when Governments do not meddle with it, was passed at the same sitting without a word of discussion.

The Purity of Water Supplies

A MEMORANDUM setting out the precautions which are necessary in the day-to-day administrations of a water supply undertaking to maintain the wholesomeness of the supply has been sent by the Minister of Health to all water undertakings, companies, and local authorities. It is stated that these precautions are no more than have been long recognised as good practice in water administration; thus as regards analysis, it is advised that where water is being supplied without treatment, the undertakers should make frequent and regular analyses of it. It is as well that the need for frequent analyses has received official emphasis, but it would still appear that the only certain way of ensuring pure water supplies would be the granting of powers to the Ministry of Health to ensure regular testing both of the raw water and of the water supplied, after receiving any treatment necessary. Water for supply which did not conform to a prescribed standard of purity could then be rejected. But it is extraordinary that water, as one of the principal municipal services to the public, should not have a legally defined limit of purity for potability.

Peculiar Circumstances in Plant Failure

THE failure of a particular vessel in the works is sometimes a matter which is difficult to understand. Various views may be expressed receiving more or less evidence of a confirming nature. A consultant may be called in to report, if circumstances justify it; the literature may be searched in anticipation of being able to throw some light upon the case. Even then the accumulated details may not afford much help, because there may be minor matters which really enter into the case and are unsuspected as being in any way responsible for the trouble which is under investigation. A recent instance of the failure of a large aluminium vessel (*Aluminium*, 20, 823) provides a typical case. This vessel was made of aluminium of 99.4 per cent. purity, and had contained alternately weakly-corrosive acid and alkaline solutions

at temperatures between 20° and 80° C. After being in service for two years, a crack developed parallel with one of the vertical welded seams and within an inch and a half from the seam. The part of the vessel that was affected lay within the area of metal which had been completely annealed during the welding operation, the aluminium metal used being originally "half hard." Closer examination led to the conclusion that the serious crack, and also a number of similar but not fully developed cracks, had really been caused by stress corrosion, that is, by stresses resulting from temperature changes. Attendant circumstances facilitating this corrosion were traced in the presence of silicon, precipitated during the welding operation as a result of the welding heat, and it was found that the whole trouble was started by the scratches caused by a scraper. The causes which can give rise to corrosion are truly as varied as the types of vessels which may be affected. This instance is typical for pointing out how very necessary it is for the plant maker to realise the ultimate effect of all possible circumstances which may arise, however minor they may appear to be.

Refugee Scientists

THE pitiable plight of scientists who have been exiled from their own countries leaves little to the imagination in its reality. Putting aside personal considerations, one of the most tragic results of their persecution has been the sudden cessation of much work of high scientific value. The appeal launched this week by the Society for the Protection of Science and Learning for funds to assist this type of refugee will especially commend itself to many. Its main object is to secure facilities for the scientists to continue their work and thus avoid a waste of specialised talents; in addition, the achievement of this object would be to the advantage of this country's technical development. It is emphasised that in no case will refugee scientists be favoured in competition with our own men. This is a very necessary reassurance from the point of view of the British scientific worker's employment.

American Recovery Continues

OUR recent notes on the recovery in the United States are confirmed by further news just received from Washington. Employment in the past four months has increased by 1,250,000, this increase being wholly in private industry. In the same period the Government has reduced the number of its relief workers by 200,000, and the intention is, as normal recovery proceeds, to make further economies in this direction. The controversy continues between advocates of Government expenditure as a means of relief and those who hold that private enterprise is handicapped by this burden, but meanwhile there can be no doubt that trade is getting better. A contributor to the *United States News* quotes the following headlines from a single day's issue of what is "probably the most conservative financial journal in America":—"A New Golden Age in Pacific Shipping," "Office Equipment Outlook Improves," "Refrigerator Sales Prospects Good," "Better Sales for Rayon Goods," "Hosiery Mill Adds New Unit," and "Steel Sales Continue Satisfactorily." Recent statistics also show that employment has increased in 31 of the 48 States, while "aggregate pay rolls" increased in 17 States. This improvement took place in November, at a time when a decline in employment is usually experienced, and is therefore the more significant.

Plant Maintenance at Chemical Works is Essential

By
A. G. WRIGHT

PLANT maintenance at chemical works is a subject which returns for review year after year. It is necessary not only to keep plant working at its highest degree of efficiency, but also from the aspect of safety, which may concern property as well as individuals. Unless plant is kept in perfect working order there can be no guarantee that the quality of the product will remain constant without special precautions being taken to assure that feature. Loss of efficiency in operation likewise means that the cost of the product will have a tendency to rise, as a result of expenditure which becomes necessary in effecting repairs and sometimes additionally by reason of a prolonged delay in manufacture due to the necessary shutting down of part of the plant to carry out those repairs. Good maintenance continuously throughout the year is therefore the wisest policy to adopt.

Looking at this subject of maintenance from an entirely new aspect it can be regarded as falling under two distinct headings, namely, stationary and moving features. In the one case there is attention for the counteracting and preventing of all conditions of corrosion of storage tanks, reaction vessels and pipework; leaks which have slowly developed in such erections as a tank which is lined with an internal tile lining, or to replace a lead lining which has worn away by mechanical action possibly under corrosive conditions. This stationary deterioration has to receive attention at irregular intervals, although the plant owner must keep continually alert in the inspection of his plant to detect when any such attention becomes necessary. Maintenance which is occasioned by moving parts is exemplified by the working parts of valves, the stuffing box for the shaft of an agitator in a closed reaction vessel, the bearings and internal features of fans and pumps, electric motors, shafting, pulleys and belts, and anything else which moves in its normal method of operation and therefore has a tendency to suffer from mechanical wear. Maintenance in this respect must be carried out regularly, although inspection is not necessarily followed by the need to effect any replacements or recondition any part of the equipment.

Special Maintenance Staff

To become effective in its highest degree the maintenance of chemical plant and all those accessory features of a chemical works, such as power producing units (i.e., electric motors and boilers for steam and hot water), material handling equipment (hoisting tackle, elevators and conveyors), and service pipework (water, steam, compressed air and vacuum) must be allocated to a special staff, one man for the small works or many men, each an expert in one or more aspects of the work, in the case of a large works. Only by this appointment of special men to do the work can a maintenance policy be properly adopted and carried through to perfection. An exception is made here, of course, in the case of a very small works where the whole-time employment of one man upon maintenance work would not be justified. If maintenance is left to be carried out as and when an opportunity presents itself, irrespective of whether it is merely inspection or the actual repairs and replacements, it will be done but little more effectively than if no one attended to it.

Besides inspecting and carrying out the work which proves to be necessary there is an almost equally important aspect of maintenance which must receive attention, namely, the keeping of a permanent record of all inspections, in which is entered an identity number for plant or equipment which is present in more than one unit, the date upon which inspection was made, results of the inspection and what repairs or replacements became necessary. Simultaneously the cost of materials and labour should be added for each part of the work, so that a final assessment of cost in respect of main-

tenance and repairs will be available at the end of the year, and one year may be compared with another and duly considered as a charge against the actual production value at the works for that year. This record of maintenance should be kept continuously, every piece of plant being entered upon appropriate sheets or cards for filing purposes as soon as received for erection or passed into store as a spare, the date of erecting and of first putting into service being the first entries.

So far as concerns tanks and pipework, with which may be included the shell or body of reaction or other vessels, it is often possible to reduce maintenance costs by a careful initial selection of the material which is employed. For instance, stainless steel may be better than aluminium or copper in one case, or *vice versa*, even if taking into account the special feature of the last-named metals. As another case stoneware or a similar material of ceramic nature will prove to be far better than an acid resisting alloy. Quite apart, however, from its usefulness in actual maintenance work the outcome of a long record of maintenance costs and details will often point the way to savings by the substitution of one material for another when the complete replacement of a vessel becomes necessary, and in some cases even before that time occurs, as it may be found that the remaining life of the vessel is greatly overshadowed by rising cost of repairs or its selling value as scrap would justify a change over to a new material at a higher cost rather earlier than really necessary.

Attention to Electric Motors

The oiling and adjusting of plant machinery is an outstanding feature of maintenance, and if it was carried out properly there would be a notable reduction in breakdowns and the costs occasioned thereby. This applies particularly to electric motors, where it should be the daily task of a skilled electrician to take readings of temperature, lubrication, belt tension, clearance, and note the possible need of cleaning from accumulated dust and dirt. Under these circumstances the burning out of a motor would be far rarer than it is for works which may be called into account. The breakdown of a motor for which no spare is available, or in substitution for which other motors have to be pressed into service at considerable inconvenience, does not end there, because the operation of the plant is also interrupted and this may prove far more costly than the actual repairs or the strict daily attention to maintenance and rewinding the motor allowing for a considerable margin of time.

Pumps, like motors, are equally essential for the continuous operation of plant wherever liquids have to be moved from one vessel to another. Here again there is need for careful attention at regular intervals, in some cases daily, to check lubrication and the temperature of the bearings. The repacking of a pump gland and the maintenance of proper clearance, done before it becomes really essential, will greatly increase the life of the pump, apart from contributing to general efficiency and a reserve for extra stresses arising from unforeseen extra duty.

It is possible that a great deal of this general servicing feature of maintenance is avoided to some extent as a regular matter for attention because motors, and also pumps and fans, are placed in positions where it is inconvenient to get at them at least once a day, and where in the case of a pump the task of disassembling the pump casing in order to examine the impeller cannot be done properly *in situ*, the only alternative being interior inspection at long intervals of time under the necessity of having the pump removed to the engineering shop for inspection. Although motors and pumps are both recognised as essential features of a modern chemical plant there is still some tendency to tuck them

away in an odd corner, where belts or couplings may not need so much more care in guarding them and where the pump inlet and outlet connections may be connected up without the need for much extra pipework. It is often found that if a pump is tucked away but still accessible, there is an attendant risk to the fitter from the close proximity of other pulleys and belts, or else lighting conditions are so inadequate that inspection in its proper sense is impossible. These two examples are merely pointed out to show that the efficiency with which good maintenance work may be carried out is not entirely dependent upon the staff detailed for those duties, and that the person originally responsible for the lay-out of the plant or for dictating the precise situation of a motor or pump should sometimes have the whole of the blame cast upon him.

Use of Corrosion-Resisting Paints

General corrosion as regards tanks and pipework is overcome, in the case of steel and iron, by keeping the metal properly painted, and using for this purpose a paint which has the desired corrosion-resisting qualities, and, in some situations where temperature is relatively high, also a desirable degree of elasticity. In the presence of corrosive liquids and fumes it is unwise to use paint too sparingly, but this does not infer that the paint is to be applied in excessive quantity as regards thickness and number of coats, but rather that the protective service is maintained continuously throughout the year and applied so thoroughly that there is no spot where corrosion may gain a foothold and continue unnoticed beneath the paint film. Here, of course, the same question of accessibility arises where pipes are present in great profusion and sometimes their arrangement is not too orderly.

Tanks which have to be painted on all exterior surfaces must be erected at a convenient distance from adjacent walls and kept well up from the floor to enable the painter to work effectively. Moreover, only when a tank is supported at a reasonably good distance from the floor is it possible to make a thorough inspection to detect leaks and then to caulk them if they are found. Equipment made of stainless steel or of aluminium can be kept in good condition without the necessity of painting, but copper equipment should occasionally receive a coat of boiled linseed oil. Wooden vessels have to receive special attention, especially in the case of very large tanks where repairs may become necessary in due course unless the wood which has been used is of the highest quality.

Brickwork and stonework which is erected to support vessels at a height most desirable for convenience in operation, or to allow the plant to be adaptable by fitting additional vessels into a circuit beneath others, is just as much subject to deterioration in the presence of corrosive liquids and fumes, and in the presence of moisture generally, as are the vessels which constitute the main features of the plant. In other words, both brick and steel must be adequately protected by the application of a corrosion-resisting paint, and the brickwork, in addition, must have protection against mechanical injury which is liable to arise from the rolling to and fro of metal drums and the movement of trolleys about the works. This protection of brickwork becomes especially important in the case of furnace settings which may be weakened and thereafter become a danger, especially in such circumstances as the setting for a caustic fire-pot which may hold a charge of decidedly dangerous proportions.

Where vessels and pipes are protected by some form of heat insulation there are two features of maintenance which have to be kept in mind. In the first place, after initial erection the exterior surface must be properly coated to give corrosion resistance before the application of the heat insulating medium, otherwise corrosion may start and proceed to a considerable extent without becoming apparent. In the second place, the coating of heat insulating medium must be kept in good condition, especially as regards its exterior canvas covering which is kept painted. Particular attention should be given at points where the pipe makes connection

with a vessel, whether insulated or not, and also to those points on pipe lines where the heat insulation tapers off for the better accommodation of a valve.

The mention of valves also raises a still further aspect of maintenance. Of all features upon a plant the valve, whether upon a pipe line or as an inlet or outlet to a vessel, is possibly the most important, because it provides the necessary means for controlling the flow of liquids or gases. Apart from the necessity of operation under normal working conditions there is also the unforeseen contingency of suddenly having to operate a valve for the sake of safety as a mere precaution. A valve which is not working properly is a danger to any chemical plant, irrespective of what liquid or gas may be flowing through the pipe line or is present in a vessel. Glands must be repacked at regular intervals and care must be exercised in not tightening the gland beyond the point necessary to ensure freedom from leakage. A gland which is tightened too much increases the difficulty of operation for the valve, and in some cases there is great risk of scoring the spindle.

Safety valves have also to receive attention, as in the presence of chemicals of corrosive nature their behaviour when the plant is working is important. Such valves must be so placed upon that part of the plant to which they appertain that there is no possibility for their operation to be temporarily impeded by contact with any other feature. In the presence of corrosive atmospheres such valves may show a tendency to stick by an accumulation of corrosion products, and it is only the regular inspection of such valves that can ensure their operation at the time when needed. For such plant as autoclaves the safety valve becomes especially important, and here, as an additional factor of safety in ensuring operation, it will be more dependable to employ safety discs, as any tendency to corrode will weaken the disc, which then fails at a lower pressure than originally designed.

Protection of Woodwork

Adequate protection of woodwork becomes important in such moisture and steam-laden atmospheres as a textile dye-house or bleaching works. Solutions of tar and creosote, with or without paraffin wax, are very suitable for the treatment of wooden floors in such situations where there is a good deal of moisture accumulating upon the floor surface. Wood which is so treated does not allow the water to soak in, and the presence of wax will not make the floor slippery unless an excessive amount of wax has been used. Situations where acid or acid liquors are liable to accumulate can adopt an acid-proof flooring tile set in acid-proof cement, or one of the proprietary acid-resisting products of which tanks are built *in situ*; blue engineering bricks provide a very good material with which to pave and build up retaining walls in such situations, using a suitable acid-resisting cement for the joints.

To carry out maintenance work at its highest degree of efficiency demands conscientiousness from the men to whom this task has been allocated, and also a good knowledge of the materials which they may be called upon to handle, such as jointing materials, gland packings, lubricating oils and belt dressings, as quite distinct from a knowledge of the particular equipment which they will have to inspect and repair or replace when the necessity arises. In some situations, however, maintenance may well be left in the hands of a member of the operating staff.

Maintenance for the prevention of breakdowns and consequent stoppage of part of the plant is really a form of insurance in which the cost of staff and replacements are in the nature of a premium paid against repairs which may prove far more costly. It is on this account that the cost of maintenance should never be stinted, because a serious breakdown will occasion a far greater financial loss than could ever be involved by excessive maintenance costs. Success in maintenance, from the aspect of costs, comes only from the keeping of precise records of what has been done in the way of inspection and what has actually been found to be necessary under the respective headings of replacements and repairs.

Maintenance of Power Plant at Chemical Works

By
D. M. CORROTT

THE subject of maintenance for power plant, with which is included steam-raising and the production or transformation of electrical energy, together with pipes for conveying steam and motors by means of which the electrical current is converted to mechanical use, is bound up very intimately with the general efficiency of chemical manufacture. Steam, hot water and electricity, as motive power and as heat, are basic to the operation of processes, and as such the necessary plant requires exceptional care to maintain a high efficiency of production and utilisation. As a maintenance feature of almost any chemical works it is, indeed, most advantageous to single out this feature from other features at the works, and to be unstinting in attention. Maintenance "about the works" generally can be left in the hands of a general maintenance staff, but for boilers and motors and associated features it is often preferable to set up a separate maintenance section and leave this work in hands which are more accustomed to the unforeseen circumstances which arise and call for attention.

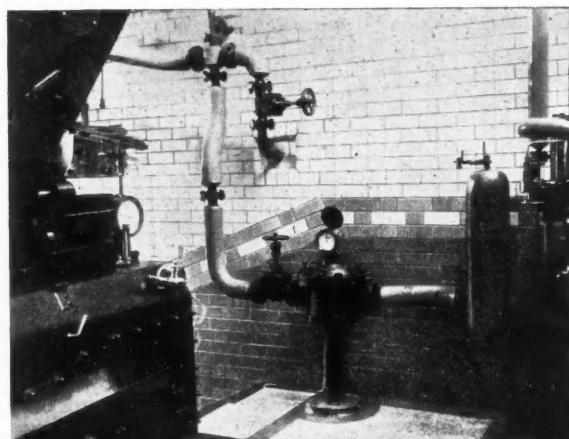
Boiler Operation

The first step towards effecting good maintenance for steam plant is to be found in the actual operation of the boiler. Steam is usually a large item of expenditure at chemical works and any irregularity in production will therefore upset the working of many other parts of the plant, not only those parts which depend directly upon using part of the steam supply, but also smaller plant features which are either accessory or dependent. For all boiler plant there should be definite instructions regarding the routine of firing, otherwise obtained by the employment of a really efficient stoker, for unless there is economy in the use of fuel and the emission of black smoke is prevented the boiler never gives its best output. If, therefore, accessory features and fittings are kept at their highest degree of working efficiency and repairs are effected immediately they become necessary or indicate need for attention, the correct operation of the boiler can equally well be considered one of the aspects of maintenance. At least, good working will "maintain" the supply of steam, and there can be no dispute that this is maintenance just as truly as attention to joints and valves upon the plant.

The firing of a boiler is a subject which cannot be summarised in a few words, but there are certain points which may be emphasised for effecting efficient operation. For instance, the boiler should be fired often and quickly, and the fire doors should never be opened except when necessary as

when adding more fuel. Half of the grate area should be fired at one time, each side of the grate being taken for firing in turn. Caution should be exercised in seeing that there are no uncovered portions of the grate through which cold air will be admitted. Generally, there is the necessity to keep the firebars clean and free from clinker; to keep the ash-pit clean, in addition, in order to allow free passage of air.

General management includes due consideration of the quality of the coal or other fuel which is purchased, taking a record of the quantity of water which has been evaporated for every pound of coal consumed. This work makes it necessary to instal a hot-water meter. If the water is fed by a pump, as is usually the case, the hot-water meter will be placed on the delivery side of the pump, but if an injector

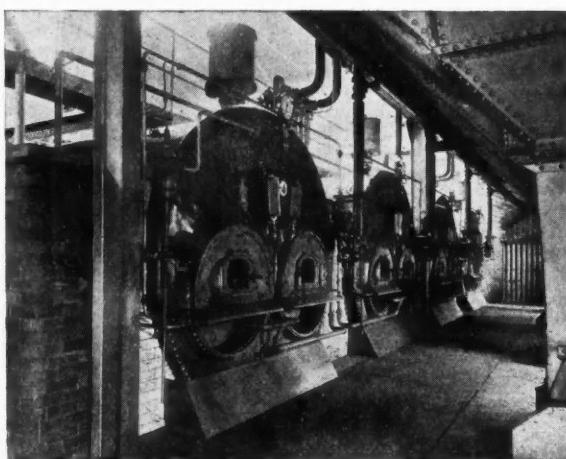


A Kent Uniform hot water meter, made by George Kent, Ltd., measuring boiler feed water to a works boiler.

is used the meter must be placed on the suction side of the injector. Read at regular intervals, the difference between each reading will give the quantity of water delivered to the boiler between the times of reading; generally it will be found satisfactory to take this reading once a week, and a note must also be made of the amount of coal consumed.

By keeping a regular record of the number of pounds of water evaporated for each pound of coal consumed, and calculating the cost of evaporating every 1,000 pounds of water, it is fairly easy to keep check upon boiler firing operation, both from the point of view of the work of the boiler-house staff, general efficiency in production and utilisation of steam, and as regards the true value of the fuel. The quantity of ash which is obtained should be ascertained by weighing, because this ash has been originally purchased in the form of coal and therefore affects the true price of coal matter actually consumed in converting the water into steam. Boiler practice as laid bare in such an assembly of figures for fuel consumed and steam produced will sometimes reveal that a low grade fuel at a low price, is less economic than a high grade fuel which is relatively expensive.

Regarding maintenance from its more usual aspect of "attending to this and that" for the purpose of obtaining the highest efficiency or the best possible service, there are a number of features which demand attention. In addition to removing the ashes from the ash-pit at least once every day, it is also necessary to take care that there is no ingress of cold air into the boiler flues by cracks which have developed in the brickwork settings. Brickwork adjacent to a damper frame and around a blow-off cock must also be examined. Tests to indicate if there is ingress of air should be made when the boilers are operating under a full load for the

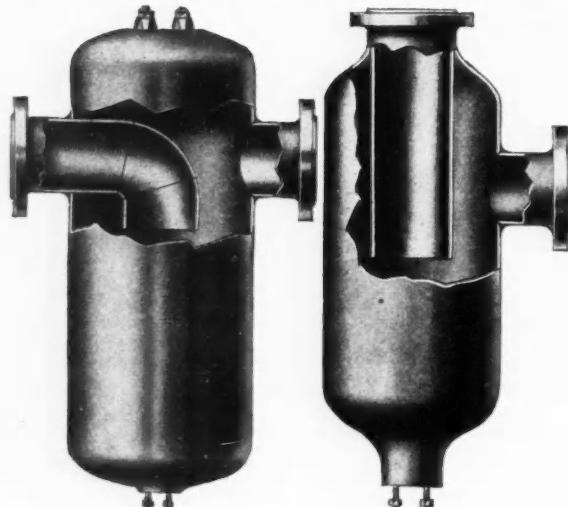


Four Lancashire boilers recently installed by Clayton, Son and Co. Ltd., Leeds, at a local gasworks.

production of steam and with the dampers open. A lighted taper is used to indicate leakage by tendency for the tip of the flame to be drawn into the brickwork at the point where the air is gaining admittance. Any such leakage must be repaired immediately, or at least as soon as possibly convenient, otherwise there may be considerable loss of efficiency.

Heat insulation upon the boiler and adjacent pipework should be examined periodically to see that it is in good condition. If repairs are found to be necessary they should be carried out without delay, because it must be remembered that the steam is merely conveying heat from the boiler to another part of the plant and any loss of heat which is suffered is really to the general detriment of all parts of the plant which are making use of the heat in the steam. One of the most effective non-conducting compositions for heat insulation purposes is "85 per cent, magnesia." Good black varnish provides the best coating with which to paint the exterior of the canvas covering which is finally wound round the insulation-covered pipework, but frequent painting will be necessary to ensure that there is no deterioration.

In addition to this, the joints of all pipework and the glands



Type A.

Type B.

Two standard type steam separators made by Babcock and Wilcox, Ltd., they are designed to give a suitably reduced steam speed through the separator, and this, combined with the change in direction of flow, obtains the necessary moisture separation. Type A has the inlet and outlet nozzles in line with each other, and Type B has the inlet at the top and the outlet at the side. The separators are all provided with mild steel internal baffles; in Type B separators, this baffle takes the form of an internal tube. The nozzles are welded to the body and can be varied in number and position as desired to meet requirements.

of all water gauges must continually receive attention to make sure that they are perfectly tight. Any leakage should be put right immediately by the use of new jointing material or a new gland packing. As a further precaution spare glasses for the water gauge should be always at hand. Defective joints upon steam pipes must be remedied as soon as it is found convenient to shut down the plant using the steam, so that the steam supply can be turned off at the boiler. Nuts or studs should never be tightened, while a steam main is actually under pressure, as there is considerable risk of an accident taking place, and such accidents have been very serious. Stop valves which are not in use daily should be turned fairly frequently to make sure that they are in proper working order, because it is not uncommon for such valves to get into a condition of being difficult to open or close when the necessity arises. Frequent inspection of reducing valves, likewise, must be stressed, and the same remark applies to the safety valve on the low pressure side of the boiler system.

Arrangements for supplying the feed water need constant attention. Feed pumps should work practically without noise, excepting that occasioned by the shock at the end of the delivery stroke. The speed of the pump must be such as will keep a constant level of water in the gauge glass of the boiler. The experienced boiler-plant engineer can obtain definite information as to the general efficiency of the production of steam by listening to the feed pumps. A "ricketty" pump will cause a positive waste of steam and can also be a real source of annoyance to the boiler house. The pump which is kept as "stand-by" may have to be brought into use at any moment, and it is therefore necessary that it should be operated frequently to show that it will be immediately available should circumstances arise. The same remarks apply to an injector which is to be used as a spare. General conditions of maintenance applied to pumps on the feed-water plant require that the pumps be kept clean and free from an excess of oil, and that they are also protected against the fine dust which issues from the stoke-hole. Stoke-hole dust is also detrimental to steam pipe covering, which demands that the dust be removed as often as possible.

Steam traps are necessary upon any system of steam pipework and steam-using equipment, but they are capable of causing large quantities of steam to be wasted if not examined once a day to ascertain that they are in proper working order. A trap which is operating efficiently will merely deliver hot water without any evidence that there is steam in the pipe; if steam is discharged the trap calls for immediate attention, and it may even be found necessary to replace it, spare traps being kept in store for this purpose. If there is no spare trap available the condensate must be run off by hand until repairs can be effected, for otherwise the steam main or the equipment using steam will be put out of use.

Importance of Steam Drying and Purifying Equipment

The installation of steam purifying and drying equipment in the boiler has proved to be highly important for reducing the maintenance costs of the equipment which is using the steam, especially in the case of steam turbines. Saturated steam from the surface of the water in the boiler contains 2 to 3 per cent, or more of water particles, which reduce the thermal efficiency and also make it difficult to control accurately a superheated steam temperature, for the simple reason that this free moisture has to be evaporated and heated in the coils of the superheating plant. In addition, solid particles of scale, rust, and decomposed packing and jointing materials may be present, and these particles can cause definite mechanical damage upon the blades of a steam turbine or the cylinders and pistons of a reciprocating engine; they also hinder the efficiency of any valves through which the steam passes. Dirty steam is also a disadvantage for general process work, especially when used direct for heating or evaporating liquid in an open vessel. It is therefore desirable to install a steam separator and drier, of which, types are obtainable to remove solid particles simultaneously with a reduction in the moisture content to less than 0.25 per cent.

A few words must be included with regard to economisers, for if made of cast iron they can be badly affected when the inlet water is not kept above a temperature of 100° F. Steel-tube economisers are subject to corrosion internally and externally and demand all necessary precautions against this.

The removal of dust which is carried by the combustion gases will greatly affect the life of induced draught fans, which are very susceptible to erosion where dust is present. The fan and all its connections must be tight against leakage in order that the most efficient service is obtained from it. Frequent examination of the blades and arms of the fan will disclose any deterioration or weakening, either by erosion or corrosion, and will avoid the breaking of a blade which may seriously damage the fan-casing and possibly be a distinct hazard to life. The use of blades made of special metal will lengthen the life of the fan and generally reduce maintenance costs, if conditions appear to be especially corrosive or other-

wise damaging. The bearings of the fan must receive frequent attention, as there is considerable wear when the fans are run at a high speed; in addition, it is necessary to guard against dust getting access to the bearings when the atmosphere surrounding the fan is dusty. Lubrication must be continuous, but any tendency to excessive lubrication must be avoided.

There is no doubt whatever that maintenance costs for steam boilers are reduced very considerably when materials and workmanship are of the best which can be obtained. For small plant the vertical boiler has an advantage because no brickwork is required for a setting, and the chimney stack, made of steel, can be carried direct from the top of the boiler or from a smoke box through the roof of the building which serves as a complete boiler house within the compass of minimum floor space. Boiler fittings are never so satisfactory as when they are of first-class quality; increased cost will ultimately prove to be less than maintenance, necessary repairs and possible replacements. Brickwork for the setting must be sound, with all precautions taken against an early ingress of air due to the draught in the furnace. General efficiency, of course, is attained by covering all exposed parts with a suitable heat-insulating material to reduce radiation losses to the minimum; this applies to vertical boilers as well as any other boiler in its brickwork setting.

There is also a further point which need be mentioned in cases where a vertical boiler is installed; namely, that the joint between the roof of the building and the steel chimney is maintained in a rain-tight condition to guard against corrosion of the top of the boiler and also corrosion of the chimney where it is not adequately protected by a heat-resisting protective coating. Maintenance costs for the boiler-house building will be reduced considerably if ventilation in the roof is adequate to permit the escape of steam which is liberated when the safety valve comes into action. General maintenance costs for steam pipework will be reduced, and the efficiency of transferring heat and power will be simultaneously increased, if pipework is so installed that all lines are as short as possible according to the location of the various parts of the works which have to be served and the amount of steam which is to be carried.

Although distilled water is costly, its use eliminates so much maintenance and repair work that the return on the cost of the investment is often very good. In any case it pays in reduced cleaning and maintenance costs to treat all raw water chemically before it reaches the boiler. Even, condensed water may need treatment to eliminate entrained gases which may cause corrosion.

Modern electric motors as power units are now very reliable and they do not need much attention provided the correct type of motor has been installed for a particular service. For instance, shunt-wound motors are to be used for work of a fairly steady nature, where a considerable range of speed is desired and fairly close speed regulation is required. Sudden calls of short duration for heavy loads, or a heavy starting duty, demands the use of a compound-wound motor. Squirrel-cage motors are to be used when constant speed is desired, provided that the normal starting duty is suitable. Heavy starting duty and the necessity for speed control requires a slip-ring motor. There are also other considerations which affect the cost of maintenance, such as whether or not the motor is of a totally-enclosed type, is self-ventilated, moisture-proof or specially protected against damage from acid splash. It is very essential to take precautions against any oil or chemicals reaching the windings; dust may be removed by the occasional use of a pair of bellows. The matter of changing the oil in the bearing sumps at least two or three times a year is also important. Wherever electric motors or generators are installed, spare armatures should be available so that they may be immediately fitted in the event of an overload which causes the existing armatures to be burned. Fuse boards also come up for review in this matter of maintenance, and it is desirable that all wiring should be tested for the continued efficiency of its insulation at least once, but more preferably twice, every year.

The Indian Paper Industry

Prospect of Development by Production of New Wrapping Paper

[FROM A SPECIAL CORRESPONDENT.]

THE Indian paper industry may take on a new line if the wrapping paper, which has been manufactured at the Indian Forest Research Institute, Dehra Dun, and is now being subjected to further tests, justifies hopes of its commercial possibilities. Experiments carried out at the Institute have shown that a very good cheap wrapping paper can be manufactured by a mixture of indigenous mechanical wood-pulp and chemical grass-pulp, raw materials for both of which are available in India in abundance. Neither old newspapers nor waste pulp now largely used in the manufacture of wrapping paper will be required for this process. The usual method of wrapping paper manufacture is to use mixtures of mechanical and chemical wood-pulp; probably India is the first and the only country to adopt this new process.

The significance of the new process is that it is hoped to build up a new industry, based on the utilisation of indigenous raw materials and thus to replace the large quantities of this class of paper at present imported. It will be difficult, no doubt, to replace the use of old newspapers, because of their extreme cheapness, but it can at least be hoped to oust a good proportion of cheaper wrapping paper at present imported. The possibilities of such a new industry may be judged from the fact that in 1937-38 alone the total imports of cheap wrapping and packing paper amounted to 11,468 tons. In addition 48,800 tons of old newspapers used for wrapping were also imported. To date the production in India of the same kind of paper, principally for the use of the mills themselves, has hardly exceeded 3,000 tons per annum, and is therefore negligible. Moreover it is made chiefly from the tailings and waste-pulp and old newspapers.

One of the expensive items in the manufacture of paper is chemical pulp; and Ulla grass, of which there are extensive supplies hitherto unutilised, is one of the cheapest raw materials for this purpose. For the other ingredient, mechanical wood-pulp, which is the cheapest form of pulp, use can be made of small-sized material, much of which is at present unsaleable and goes to waste.

Letters to the Editor

The Five Day Week

From Lt.-Col. Sir George Beharrell, D.S.O.

SIR,—I am very interested to hear that your company, Benn Brothers, Ltd., is celebrating in April the 21st anniversary of the introduction in your business of the five day working week.

My company's principal factory, that at Fort Dunlop, has been working a five day week for nearly twenty years, and with some unavoidable exceptions, all our offices and factories in this country are now on the same basis.

As a result of our experience, we are convinced that, speaking generally, a five day week gives the company better results, both in the works and offices, than the six day week, and although a certain amount of conservatism, and some initial difficulties of adjustment had to be overcome in the early stages, we have found that no department that has once adopted the five day week ever desires to go back to the old system.

Your company has reason to be proud of its pioneering efforts in this field, and I believe that in time your example will be generally followed with substantial benefits to the community:—Yours faithfully,

GEORGE BEHARRELL,

Chairman.

Dunlop Rubber Co., Ltd.,

St. James's House,

St. James's Street, S.W.1.

February 3, 1939.

Death of Professor Arthur Smithells

Eminent Services to Chemistry

WE regret to announce the death, at Lissenden Mansions, N.W., on Wednesday, of Professor Arthur Smithells, C.M.G., D.Sc., F.R.S., Emeritus Professor of Chemistry at Leeds University, and formerly director of the Salters' Institute of Industrial Chemistry. Professor Smithells, who was 78 years of age, was educated at Glasgow University, Owens College, Manchester, where he was Dalton Chemical Scholar and later assistant lecturer in chemistry, and at the Universities of Munich and Heidelberg. At Glasgow University he studied under Lord Kelvin (then Sir William Thomson) and Professor Ferguson. After working at Owens College he went to Germany in 1882 to study organic chemistry under Professor V. Baeyer at Munich. Later he applied himself to inorganic chemistry at the famous Heidelberg Laboratory with the celebrated Professor Bunsen as his teacher. In 1883 he returned to England, and after a brief period as demonstrator and assistant lecturer, was appointed in 1885 professor of chemistry at Yorkshire College at the age of 25, in succession to the late Sir Edward Thorpe. He was one of the most active agents in converting the Yorkshire College into Leeds University, and took over the Chair of Chemistry when the latter became self-contained. Under his guidance a special Department of Organic Chemistry with its own professor was created and later a Department of Physical Chemistry under a lecturer. He did most useful work as Chairman of the Board of Science and Technology and as a member of the Convocation, the Council, the Senate and the Court of the University, besides being Pro-Vice-Chancellor for two periods.

Professor Smithells was an authority on the structure and chemistry of flame and invented a device by which the Bunsen flame could be separated into its constituent parts and the interconal gases analysed. He analysed the interconal gases for flames of ethylene, methane, pentane, heptane, benzene, and coal gas. The analyses proved that the combustible gases in the inner cone of the Bunsen burner are partly burnt, and produce a mixture of oxides of carbon, hydrogen, and steam without the separation of any carbon. This disproved the current belief that hydrogen burned first in the flame of a hydrocarbon, and was a great stimulus to research by experiment and theory on combustion. It was his work on flame which brought him into connection with the gas industry and he gave invaluable assistance in developing the chemical side of that industry. He became chairman of a Joint Committee of the Institution of Gas Engineers and the University of Leeds, established for carrying out research into important problems in the industry. He was appointed President of the Society of British Gas Industries in 1911.

During the War Professor Smithells played a distinguished part in anti-gas organisation. He was Chief Chemical Adviser for Anti-Gas Training of the Home Forces, in which position he attained the rank of lieutenant-colonel and was later made a C.M.G. In 1923 he resigned his chair at Leeds after thirty-

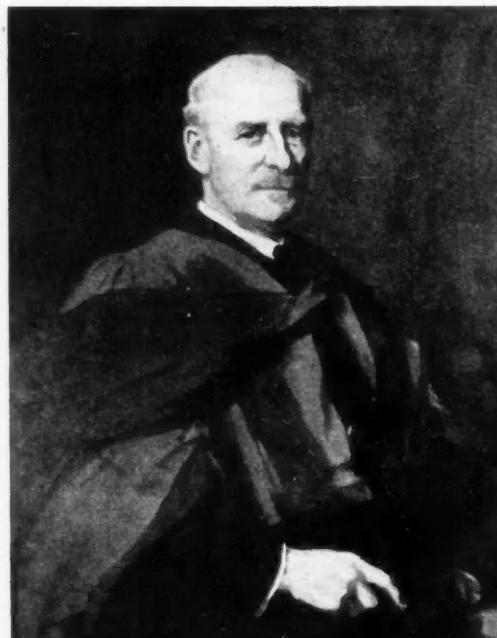
eight years of service and was appointed Emeritus Professor. In the same year he became Director of the Salters' Institute of Industrial Chemistry and retained this position until 1937. It was in this period that he occupied the presidential chair of the Institute of Chemistry from 1927 to 1930.

Among societies connected with his own science he was an outstanding figure. He was elected a Fellow of the Royal Society in 1901 and in later years he became one of the governing body of the Society, a member of the Council in 1912-13, and again for two years from 1915 to 1917, during which time he was also vice-president. He served on the Council of the Chemical Society, and was also a vice-president of the same body. He was the first president of the Society of Chemists and Colourists.

Besides being a contributor to *THE CHEMICAL AGE* and a personal friend of its first editor, Professor Smithells was actively interested in *Discovery* which for many years was also published by Benn Brothers, Ltd. As a popular journal of knowledge, this was started in 1920 by Trustees representing the Royal Society and the British Academy, and Smithells was elected to the managing committee. The object of affording a platform for authoritative articles written for the "man in the street" was very much after his own heart, because throughout his administration at Leeds University, Smithells had striven first and foremost to relate science to everyday life. *Discovery* was transferred from John Murray to Benn Brothers in 1924, and when Mr. John Benn took over the editorship in 1926, Professor Smithells soon became a valued adviser and friend.

"To what the novelists call an 'old-world' courtesy," Mr. Benn writes, "Smithells added a keen sense of humour, shown in a twinkle of the eye which became more pronounced in any company that was taking itself too seriously. One of my trials as the young editor of *Discovery* was to keep a straight face at committee meetings. All branches of learning were represented, and there was inevitably a certain amount of jealousy between science and letters. When some particularly awkward or even silly question was posed, Smithells would throw a wicked glance across the table, which more than once necessitated a hurried use of a handkerchief to smother my mirth. At these meetings, Smithells would also draw portraits on the blotting paper, having a real gift in this direction. After one meeting which I was unable to attend, he sent me a 'strip cartoon' which needed no names to identify those present. But beneath one particularly solemn face he had written *tres sec!*!"

A tribute to Professor Smithells would be incomplete without a reference to his home life, which was particularly happy. Those who visited him at Lissenden Mansions were shown with obvious pride many snapshots of his children and grandchildren, and all the Professor's friends will extend their deepest sympathy to Mrs. Smithells and her family in their great loss.



The late Professor Arthur Smithells, F.R.S.

Maintenance of Evaporators and Drying Plant

By

BRIAN N. REAVELL, B.Sc., A.C.G.I.

EVAPORATION in one form or another is common to almost all chemical processes and a large number of different types of evaporators are employed for various purposes. Any plant which is used to concentrate a liquid is generally termed an evaporator and of all the multitudinous types the simplest, and most common, is undoubtedly the open pan evaporator. In this type the pan, or vessel, is provided with a steam jacket and the liquid in the pan is boiled and the vapours dispersed in the surrounding atmosphere. The construction is so simple that any defect is, as a rule, immediately apparent but a number of points should be observed to ensure the highest efficiency.

The rate of transference of heat from the steam jacket to the liquid contained in the pan is dependent on the conductivity of the pan wall and it is, therefore, essential to keep the pan clean and free from scale or deposit. Where an easily scaling liquid is being handled it is often worth while cleaning out the pan between every charge as, in this way, steam consumption can be reduced and the rate of evaporation increased. The steam jackets should be free from leaks at the welds, rivets, or bolted flanged joints, and the steam connecting pipes maintained in good condition.

Maintenance of this sort is, perhaps, rather obvious in a well organised works and would be part of the normal routine. It is, however, just as important to ensure that the condensed steam forming in the jacket is removed continuously and not infrequently this point is overlooked. The heating of the liquid in the pan is only efficient when the steam is condensing on the inner wall of the pan; the condensed water formed must be removed as quickly as possible and any obstruction in the condensate pipe work, or faulty operation of the steam trap, will allow condensate to build up in the pan and seriously impair the heating efficiency. For this reason good quality steam traps are essential and a regular observation as to their behaviour is important.

From the point of view of safety the relief valve should be inspected at regular intervals and checked to make certain that it opens at the correct pressure. The requirements laid down by the 1937 Factory Act are open to some misunderstanding but it is often considered necessary to provide hand-holes in the jacket of evaporating pans to enable internal inspection to be carried out at least once a year. It is always advisable to obtain the ruling of the local factory inspector on such matters.

Some jacketed pan evaporators are fitted with a level gauge to indicate the presence of condensed steam in the jacket. These gauges should be blown out periodically to make sure there is no blockage which might cause false reading.

Air Release Valves of Jacketed Pans

It is normal practice for makers of jacketed pans to fit an air release valve at the top of the jacket. The correct use of this air release valve is not always appreciated by the works engineers. Apart from the air contained in the jacket before steam is blown in, there is always a small quantity of air accumulating when the jacket is working under pressure and this air release valve should be examined periodically to make sure that a whisp of steam is blown out and that no pocket of air has formed at the top of the jacket. The rate of evaporation can be halved if the air accumulating at the top of the jacket is not released continuously.

Some open jacketed pan evaporators are fitted with stirring gear to increase the turbulence of the liquid and promote a higher rate of heat transference. The stirring mechanism should be kept in good order and the gears and bearings greased at fixed intervals.

Another simple form of evaporator, which is used exten-

sively, is the closed jacketed pan working under vacuum and the remarks regarding the open pan evaporators apply equally to the vacuum evaporators. There is, in addition, however, the question of the condensing and vacuum system to be considered. A surface condenser is generally employed for this type of plant and it is most important to keep the condenser tubes clean to maintain efficient operation. Not only should the tubes be cleaned internally, if there is any tendency of formation of scale by the condensing vapour, but also the cooling water space requires occasional attention, particularly when canal or river water is used. An accumulation of sediment from the cooling water will quickly reduce the efficiency of the condenser and upset the vacuum system. Where dirty water must be used it is always best to fit a filter on the water supply rather than to allow the condenser to become choked and dirty.

The joints on the enclosed pan vacuum evaporator must be kept tight, and the condenser tubes checked for leakage; it is usually a simple matter to re-expand condenser tubes or tighten the ferrules where these are fitted. Leakage of external air into the system quickly reduces the efficiency of the evaporator and in some cases upsets the product produced if the vacuum is lowered and the boiling point increased.

The many types of continuous evaporators which are in use may be divided roughly into two categories: the long tube evaporators and the short tube evaporators, but in each category there are widely differing designs in use.

Calandrias of Continuous Evaporators

In general the continuous evaporators comprise one or more tubular heaters through which the liquor flows and these heating sections are generally termed calandrias. It is just as important to maintain clean heating surfaces in these continuous evaporators, although the formation of scale on the tubes is usually very much less than in the case of the open pan evaporator. The high velocity of liquid through the tubes prevents scale formation and de-scaling need not be carried out so frequently.

In the short tube evaporator there are, as a rule, quite a number of tubes in the calandria and it is important to make sure that no leakage of steam is taking place. A regular test on the calandria should be carried out by applying steam with no liquid in the tubes and watching for signs of steam coming out of the tube plates, or through the tubes themselves. Modern mechanical power driven tube cleaning devices are available which enable the scale to be removed quite rapidly. There are also proprietary brands of de-scaling liquid which can in some cases be used successfully.

The loss of time wasted in cleaning the calandria tubes can be quite a considerable item with an easily scaling liquid unless the best methods of de-scaling are carefully studied; wherever possible a mechanically operated cleaning tool is advisable, the initial cost is low and the saving in time quickly outweighs capital expenditure. Where copper tubes are fitted in the calandria it is dangerous to use a sharp edged scraping tool as the copper is soft and easily scratched.

During the regular examination of the calandria any tubes which are suspected of leakage, or which have worn thin, should be removed and replaced with new tubes. This ensures against breakdown while the plant is in operation, which may prove costly. The long tube evaporators have the advantage that there are fewer tubes in the calandria for a given heating surface, but it is equally important to maintain a scale free tube. On this type of evaporator inspection of the tube ends and tube plates is very simple.

The work involved in cleaning calandria tubes on both types can be reduced if care is taken in the operation of the

plant. If the evaporator is stopped for any reason the liquor left in the calandria should be drained out and the whole calandria filled up with distilled water. This not only prevents slow formation of scaling during the period of stoppage, but in many cases softens any scale which has already been formed. It is a simple matter to fit a store tank above the calandria and run the condensed steam from the calandria with a lifting type steam trap up to the tank. This water is then available at any time for filling up the calandria after a stoppage.

When forced circulation is used in an evaporator the efficiency of the plant is dependent to a considerable extent on the velocity of the circulating liquid and it is, therefore, of utmost importance to keep the circulating pumps in good repair. These are usually external centrifugal pumps and it is good practice to fit a pressure gauge, or manometer, on the delivery side of the pump so that any falling off in the rate of circulation will be detected immediately by a reduced pressure on the gauge.

Some forced circulation evaporators are provided with internal propeller pumps at the base of the calandria. In this case the direct measurement of the pressure cannot easily be obtained, but regular inspection of the moving parts and an occasional check on the dimensions of the impeller will ensure against loss of efficiency.

The auxiliary equipment associated with evaporating plant, such as the vacuum pumps and condensers, must be maintained in good order. It is always difficult to locate a leak in the vacuum system and a faulty joint is usually found by carefully tightening all flanges and pipe connections under suspicion.

Unusual behaviour of an evaporating plant is sometimes due to variations in the steam pressure, particularly where the plant is supplied with steam at a high pressure reduced down to a lower pressure for operating the calandria. With a continuous evaporator it is important to maintain a steady steam pressure to obtain a constant output of concentrated liquor. If the high pressure steam is reduced by a hand control valve some fluctuation is almost certain to occur. In this case it is always an advantage to use a reducing valve to give steam at required pressure, followed by a hand operated control valve. The working of the reducing valve should be checked frequently.

The operation of drying is really another stage of evaporation, but it is generally understood to imply that the finished product is evaporated to the solid state. The commonest form of industrial plant used for this purpose is the drying room with shelves, or in the case of smaller units the drying cupboard with trays. These driers can be used for such a wide variety of material, and operated at such varying temperatures, that they are found in all branches of the chemical industry, although, as a rule, they have not a high drying efficiency.

Whether steam or gas is employed as the source of heat the most important factor to consider is the distribution of the hot air or gas produced. It is true to say that in many cases these driers have not been designed, but have gradually grown from a small unit and the utilisation of the heating medium is far from efficient.

The hot air which is to carry out the drying process should be distributed uniformly over each tray and to check the flow of air a smoky cloud can be formed in the drying room by burning an oily rag; if it is seen that the hot air rises to the top of the room, or cupboard, passing the lower trays and only distributing its heat on the top trays improvement can sometimes be effected by fitting baffles, or deflectors, to even up the distribution of flow across all the trays. The maintenance engineer may find this method of studying the path of air flow quite helpful and a means of increasing the efficiency of existing driers.

Not only must the hot air flow uniformly over the trays, but means must be provided to remove the moisture laden air from the cupboard. Here again experiments with a smoky stream are helpful in determining whether pockets of

stagnant moisture-laden air are forming in the top of the drying room, in which case additional outlets can be fitted. Most modern drying rooms are equipped with forced circulation for the hot air; this greatly improves the efficiency owing to the higher rate of heat transfer and better distribution across the trays. In such driers it is important to maintain the correct volume of air in circulation and the fans and driving gear should be kept in good order. Both steam and gas fired forced circulation drying rooms can easily be equipped with thermostatic controls, which ensure a constant temperature and uniform drying conditions for the material being handled.

Where a powdered material is being dried it is almost impossible to stop fine particles of powder from being picked up in the air stream. Some drying systems employ re-circulation of the hot air and the heating coils, or tubes, become coated with a film of powder from the air stream. This reduces the efficiency of the heater and in such cases the tubes should be cleaned regularly.

The insulation of the drying room, or cupboard, is sometimes overlooked and great economy can be effected by suitable lagging. Where low temperatures, up to about 180° F. are employed, it is usually a simple matter to encase the walls of the room with strawboard, or other prepared insulating panels; for higher temperatures asbestos millboard, or plastic lagging, is most suitable. The heat loss from a drying room 10 ft. by 7 ft. by 15 ft., with badly lagged walls when working at 250° F., may be as much as 100,000 B.Th.U.'s per hour, which is equivalent to a loss of 110 lb. of steam per hour. This could easily be reduced to a steam loss of 55 lb. per hour by the addition of $\frac{3}{4}$ in. thick millboard round the walls.

Of the many continuous driers in use for chemical and food products the roller, or film drier, is the most general. It is essential with this type of drier to maintain a constant film of uniform thickness on the whole length of the drum and the film, when dry, must be completely removed by the knife or scraping gear.

There are many different means of feeding the material to the drum and scraping the dry film off, but the efficiency of this type of drier is dependent mainly on the successful operation of these two items. Once the feeding mechanism has been adjusted it will, as a rule, work for long periods without maintenance, but the scraping mechanism should be examined at frequent intervals. Where one single knife is used it must be carefully adjusted to bear up against the drum at all points. Unless the knife bears uniformly along the surface, part of the dry film will stick to the drum and prevent the oncoming wet film from being dried. In some driers the scraping mechanism comprises a series of small knives overlapping each other and on this type, once each knife has been properly adjusted, the plant will run for quite a long time without further attention to the scraping mechanism.

When adjusting the knife on any type of drum drier it should be done when the drum is hot. The expansion of a 3 ft. diameter drum from 0 to 60 lb. per sq. in. is approximately 0.10 inches on the diameter so that too great a pressure would be exerted on the knives if it was adjusted when cold.

The condensed steam which forms in the drum must be removed continuously to ensure efficient working. If the steam trap is faulty, or a blockage occurs on the outlet steam pipe, the drum will fill with condensate and the output of the drier rapidly falls off. Regular inspection of the steam trap and exhaust pipe system should be made to prevent this happening. The air release valve which purges the drum from entrained air should be kept slightly open and a whisp of steam blowing off during the working of the plant.

There are several other continuous types, such as the rotary drier, band drier and spray drier, but as these machines are usually made to suit individual drying problems no general remarks would be applicable. Apart from the routine maintenance it is always advisable to consult the manufacturers of such special plant on any problem relating to performance and upkeep.

Electric Arc Welding for Chemical Works Maintenance

By
E. DACRE LACY, M.Inst. W.

ELECTRIC arc welding has been used for a considerable number of years in the chemical and allied industries for the maintenance and repair of works plant. There are many instances, far too numerous to mention, in a chemical works where the possession of a welding plant has prevented the scrapping of expensive machinery and the consequent purchase of new plant.

However, the maintenance of plant for the chemical industry has set for some years a difficult problem for engineers. It is essential for the chemical manufacturer that plant for this purpose should be of high-class quality, because, in the manufacture of chemicals, so much depends upon the purity and uniformity of the constituents and the vessels in which they are made.

Electric Welding for Mild and Stainless Steels

For this type of work, there are roughly two classes of steel used: mild steel and stainless steel, the latter comprising a number of specially manufactured proprietary brands of corrosion and heat resisting steels. In the construction of vessels for the chemical and allied industries in both mild steel and stainless steel, electric welding is now considerably used. In fact, it might be stated it is a very rare exception to find products of this type fabricated by any other means.

In the welding of both these types of steel, it is essential that the article so manufactured should possess the required finish, and to obtain this it is essential to have an operator who has some knowledge of the underlying principles relating to metallurgy, and especially to the use of special steels. It is also of great importance that the correct electrode should be used, and in these days it is not difficult to obtain the right electrode for the right job, as the principal manufacturers of welding material now produce an electrode for almost all the alloy steels, guaranteeing that the deposit from the electrode will be of the same composition as the parent metal.

A type of application under the heading of general works requirements, is found in the use which has been made of welding in order to replace parts which previously would have been cast or riveted. A typical example of this application is found in the welded steam jackets required for autoclaves. The shape of this particular job, with its branch connections, etc., lent itself particularly to welded construction, whereas some years ago castings, with their attendant uncertainties and limitations as far as design was concerned, would have had to be employed. As an example of a typical case where welding has largely replaced riveting, a large distributing hopper may be cited; this was also welded.

With the advent of specially constructed plant in the chemical industry, there has arisen an increased application of the various welding processes, viz., oxyacetylene welding, resistance welding and metallic arc welding. In this article, however, we are only concerned with the latter.

Importance of Composition of Metal Deposited

If satisfactory results are to be obtained in the welding of stainless steels, it is essential that the metal deposited in the weld should comply precisely and exactly with the specification of the metal being welded. Unless such results can be achieved, failures are bound to occur. A certain amount of difficulty occurs in the welding of certain steels, resulting from the effect of the welding heat upon the crystal structure of the plate in the adjacent zone. It is, therefore, advisable to consult the makers of the steel used before carrying out any extensive welding work or to communicate with the manufacturers of electrodes, who will be most pleased to give advice on matters of this kind.

Either A.C. or D.C. machines can be used in the welding of chrome nickel steels, but with the former the best results

are obtained with a plant with an open circuit voltage of 100. Owing to the finer current regulations usually obtainable, the D.C. plant should be used where available. The finer current regulation, obtained on D.C. machines fitted with a field regulator, makes them the most suitable, providing an open circuit voltage of 60 or over is available. Sliding-core choke coils are eminently suitable for use on A.C. machines for welding stainless steel, as an infinite graduation of current strength is obtainable and can be fitted to any make of welding transformer.

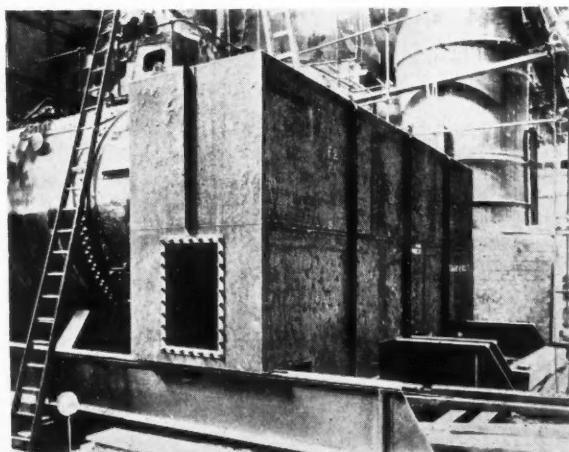
The actual welding of these steels should be no more difficult than working on mild steel, but it is essential that the metal should not be kept in the molten condition for too long a period by making exceptionally wide runs. It is, however, important at the end of a run to trail the arc away from the weld in order to avoid porosity if the electrode is lifted away; this is even more important when dealing with stainless steel than with mild steel. By maintaining a short arc and depositing narrow beads the effects of oxidation by the atmosphere are very slight.

Smaller gauges of electrodes and lower current strengths than for welding mild steel should be used and it is also necessary to spend more time in setting up the work. The general rules for avoiding distortion are: leaving a gap at the bottom of the joint, allowing the seam edge to diverge from the starting point of the weld, avoiding, if possible, the welding together of unequal thicknesses, and extra care in the preparation of joints.

Avoiding Contraction Stresses in Stainless Steel Welding

The principal points to be observed in welding stainless steel are the avoidance as far as possible of contraction stresses during and after welding and the prevention of alteration of composition and structure of the metal alongside the weld. The general rules for the prevention of contraction stresses are similar to those for mild steel. The avoidance of notches on the back of the weld will prevent the possibility of local corrosion and if it is found on examining the underside of a weld that penetration has not been complete throughout the whole length of the seam, a light run with a small gauge of electrode should be put on.

Chrome nickel steels of the 18/8 or 15/11 group are spoilt from the point of view of corrosion resistance if they are heated for any length of time between 500°-900° C., but can be restored by subsequent annealing at 1,150° C. It is therefore necessary to anneal at the above-mentioned tem-



Electric arc welded dust boxes for boiler flues.

perature all vessels which have been welded, as, although the temperature of the arc is about $7,000^{\circ}\text{C}.$, there is bound to be an area alongside the weld where the temperature has not exceeded $900^{\circ}\text{C}.$

The addition of tungsten and also titanium in even so small a proportion of 1 per cent. each minimises the risk of what is commonly called "weld decay" in the plate, and if corrosion conditions are not severe and the weld carefully made, annealing need not be done. Prolonged heating during annealing should be avoided and the article cooled rapidly by air blast. The effects of weld decay are more pronounced when the metal has been stressed by flanging or working to shape before welding, or by contraction during the welding operation.

Advantages of the Arc Welding Process

The greater speed attained by arc welding reduces the amount and area of disturbance to a minimum as compared with other welding processes. Metallic arc welding has the advantage of avoiding any increase in carbon content in the weld metal. The great majority of welding of both classes of stainless steels and particularly of the austenitic steels, except for very thin materials, is now carried out by this process. Owing to the high coefficient of thermal expansion of the austenitic materials and the importance of as short a heating time as possible from the corrosion point of view, the high welding speed and consequent relatively low heat input are a great advantage. Distortion is minimised and it is possible for those materials, dependent upon a short heating and ultra-low carbon content, due to their resistance to inter-crystalline corrosion, to pass the standard Air Ministry test (immersion in a solution of copper sulphate and sulphuric acid) most satisfactorily when welded by this process.

When welding by this process the electrode should always be of the same type of material as that being welded. Suitable electrodes are obtainable from several well-known specialist firms. The parts to be welded should be clean, and, when welding, the arc should be as short as possible. A long arc usually results in improper fusion and lack of penetration. The deposit is also liable to be unsound.

The values for current depend largely on the particular job in hand, but the following give an indication of the most suitable current for the average job:—

8 gauge electrodes	...	...	...	110-120 amps.
10 "	"	...	...	80-90 "
12 "	"	...	...	45-65 "
14 "	"	...	...	25-40 "

Before depositing a second layer or before welding the reverse side, the surface should always be cleaned.

Owing to the development in recent years of electric arc welding plants specially designed for the welding of light gauge sheets, it is now practicable to butt weld "Staybrite" steel sheets as thin as 18-20 gauge.

Arc Welding and Non-Ferrous Metals

Included amongst the non-ferrous metals that can be successfully welded by the arc welding process are copper, brass, bronze, Monel metal, nickel and, only recently, aluminium. In spite of the fact that a considerable amount of experimental work has been done in connection with the electric welding of copper and its alloys, welding by this process must be handled with caution. To obtain the best results, flux-coated electrodes should be used, and the operator should have some knowledge regarding the characteristics and working of such alloys.

From the point of view of welding, copper differs from iron or steel in two very important respects: it has a much higher thermal conductivity and it oxidises much more readily at high temperatures. The heat induced into the copper by the arc is rapidly conducted away from the welding locality so that the depositing metal freezes before complete fusion is consummated. Preheating, then, is an essential condition for

the production of homogeneous junction between weld and base metals. The oxygen of the atmosphere combines with copper at high temperature to produce cuprous oxide, which, when distributed throughout the metal, has a highly injurious effect upon its mechanical properties, particularly ductility. Oxidised copper is easily fractured and the presence of cuprous oxide can be detected in the form of brick-red patches or under the microscope as pale green areas like miniature lakes. The exclusion of oxygen is effected in arc welding by the use of electrodes with a suitable covering of flux which acts as a deoxidising agent and provides a protective blanket over the deposit during the cooling period.

The main essentials for metallic arc welding of Monel metal and pure nickel are:—

(1) Reversal of polarity, i.e., the work should be negative instead of positive.

(2) The use of the correct diameter of electrode for the thickness of material being welded. The electrode diameter should be rather greater than the thickness of the sheet, e.g., on 14 I.S.W.G. sheet use 12 I.S.W.G. coated electrodes.

(3) The correct control of the welding current. Highly satisfactory results over a considerable range of work have been obtained, using 65 amps. at 35 volts with direct current welding plant.

(4) A satisfactory deoxidiser and flux coating on the electrode. The flux used must possess certain definite characteristics:—

(a) Good deoxidising qualities.

(b) Good fluxing qualities for any oxide formed.

(c) Good slag-forming qualities—the slag to float readily to the top of the metal and protect it from oxidation during solidification.

Close-pitch Tacking with Monel Metal

Close-pitch tacking—not more than 6 in. pitch—is an essential precaution prior to electric welding, particularly with the thinner gauges (10 I.S.W.G. and less) of Monel metal or pure nickel sheet.

Apart from the foregoing requirements, the practice in the metallic arc welding of Monel metal and nickel is practically identical with that for steel welding and no further comment is therefore necessary. For this, flux-coated electrodes should be employed. The welding rods carry a relatively thick coating which enable the maintenance of a uniformly short arc, the work being made negative. Since the molten metal is extremely fluid, good penetration is practicable. This point is of particular interest in the welding of sheets less than $3/16$ in. thick, where, in the case of butt joints, sufficient penetration must be obtained to permit grinding and polishing of the penetrated weld on the under side, while enough reinforcement remains on the top side of the weld to provide strength and adequate stiffness.

ESTIMATION OF SODIUM

Barreto (*Giorn. dei Chim.*, 1938, 346) describes the use of resorcinolsulphonic acid for the qualitative and quantitative determination of sodium. The reagent is prepared by heating 100 grams of resorcinol with 500 grams of sulphuric acid (sp. gr. 1.84) to $120^{\circ}\text{C}.$ for 1 hour. This is then cooled to $30^{\circ}\text{C}.$, 500 grams of crushed ice added, and stirred until the ice has dissolved. In the presence of sodium compounds this reagent forms a crystalline white precipitate which is only very slightly soluble in water and is insoluble in an excess of reagent. Tests are made by using a 20 per cent. solution of the salt to be tested, adding 25 cc. of reagent for every gram of salt, allowing to stand 30 minutes, and filtering. After washing 4 or 5 times with reagent, then with alcohol and finally with ether, weighing gives the amount of sodium present. The batch of reagent can be standardised by titration against NaCl. Potassium produces a precipitate of similar appearance to sodium but it dissolves in excess of reagent.

From a Works Maintenance Note-Book

GOOD maintenance is attained by regularity in the inspection of plant and immediate attention to replacements and repairs where they are found to be necessary. There must be no inclination to put off the work on the ground that the pressure of present manufacturing operations does not allow time for strict adherence to an adopted schedule of duties. It is often when the plant is working at the highest pressure that something fails and a breakdown occurs with various degrees of severity. To have to stop the plant, or even one feature of it, during a period when manufacture is endeavouring to keep pace with sales, is likely to be very serious, for although orders may be met with but a short delay there is a general tendency for all of the routine to be hindered for two or three weeks ahead and the results are cumulative. In addition, delay in delivery of the manufactured product can be regarded very seriously by the buyer in industry, and repeat orders may be placed elsewhere to avoid a repetition of an identical state of affairs.

* * *

From the effective aspect of maintenance it is very necessary to keep precise records of each inspection and of what has to be done in the matter of any replacements or repairs. When records are reviewed side by side with the daily log of operations, showing duration of working and throughput of material, there is much useful information to be obtained; it would not be wise to cut maintenance in any way without such a comparison being made. The record of replacements should note particularly any special grade of jointing, packing or fittings, and also such details as apply to the correct lubricating grease or belt dressing. Difficult repairs which need attention on the spot are often profitably recorded in a little extra detail for consideration when generally reviewing the plant as a whole with large-scale improvements in mind, or when it is found necessary to purchase new plant to extend operations in keeping with increased business. It is often some apparently minor detail which gives difficulty in the repair work, or even lengthens the time needed in effecting a replacement, and costs can be reduced by due consideration of the available facts if records have been kept consistently throughout each month from the date of first installing the plant or any single unit feature of it.

* * *

Many users of chemical plant distribute their maintenance in a somewhat illogical manner. They do not apportion it with due consideration for its relative urgency or need, or by reference to the intensity of operation, or even with note of long or short periods of idleness. Plant which is idle is not to be taken as "not needing attention" from the point of view of maintenance. Lying idle must never affect the speed with which operations can be resumed, and this applies especially to an individual feature of a large plant, such as a pump or one of the vessels. Corrosion often proceeds at a much greater rate when plant is not in use, although mechanical wear ceases. For some plant accessory features idleness may easily establish inoperable conditions, as in the case of valves upon a disused pipe-line, or sumps in which an accumulation of liquid may evaporate to give a sludge which slowly hardens into a cement-like material to choke the connections unless cleaned out as during regular operation of the plant.

* * *

The adoption of chemical stoneware in certain situations can do much to reduce the frequency of replacements and sometimes almost completely eliminate maintenance. There are, indeed, many such situations. An instance comes to mind upon a plant where 6 in. overhead pipes had to be replaced continuously at intervals as frequent as three or four weeks, due to attack by a waste vapour of the highest corrosive nature. The situation was a cocoa works where waste gases containing acetic acid and acrolein had to be conveyed from the cocoa roasters. The only alternative to high main-

tenance costs was a replacement of the whole of the pipework by some new choice of material. Many different materials offered themselves, but the choice fell to chemical stoneware, and there was no regret. The new pipes not only resisted the action of the vapours extremely well, but also acted as air-cooled condensers, so that the bulk of the corrosive vapour was condensed just before reaching a convenient pipe for the collection and removal of the condensate. The disadvantage at first raised regarding stoneware was to the effect that there was much additional weight to be supported, but experience proved that the new stoneware pipes could be carried quite easily from the existing roof structure by means of hangers of standard design. Joints in the sockets of the stoneware pipes were "made" by first packing the sockets with asbestos cord and then using a mixture of asbestos powder and sodium silicate solution to provide a suitable sealing cement. Another objection raised against the adoption of stoneware was due to temperature conditions on the pipe-line close to the vapour take-off, but even here the users were much surprised to find that chemical stoneware stands up against fairly high temperature conditions if the warming up is done gradually, and allowance is made for the expansion to be taken up at the socketed joints and short lengths of pipe are employed.

* * *

Regarding the correct distribution of attention from the aspect of maintenance, let it be remembered that a couple of valves or a gland upon the agitator shaft of a mixing tank, or the gland upon a centrifugal pump, can receive so much and so regular attention that they will be free from trouble for long periods of use. If a breakdown occurs it is neither due to valves or glands, but rather a short-sighted policy regarding belts. The replacement of an old belt by a new one, of course, should not make it necessary to shut down the plant, but it can be due to good luck rather than good management that an accident is not also attended by personal injury or even a fatality. Quite apart from this, however, the use of an old belt does not help in obtaining the highest transference of power.

* * *

Structural means for reducing or even preventing corrosion should receive more attention than they really do; there is adequate evidence for apparent attention by the selection of special materials of construction. Mistakes in the design of plant, or rather individual plant units or features, can lead to increased corrosion as the result of galvanic action due to the juxtaposition of metals having different electrochemical potentials. Where contact between two different metals under conditions favourable for galvanic action cannot be avoided, the potential can be reduced by coating one of the metals with a third metal, or in the case of a bolted flange connection by using an inset of the third metal. For instance, zinc or cadmium foil can be used at the joint between iron or copper alloys and aluminium or aluminium alloys. In the absence of such a precaution, prospects for the development of corrosion at the joint would be a continual source of trouble. Avoidance of all dead corners in vessels will also greatly reduce maintenance so far as necessitated by troubles from precipitates being deposited in these corners. Proper facilities must be provided to remove any deposits, whatever the nature or use of the vessel.

* * *

Cocks and valves which are fitted with a key for turning demand that the proper key be used, and that spanners and wrenches are avoided for the reason that they quickly damage the square projection of the plug. Lubrication, applied sparingly, is essential if cocks are to be operated easily; graphite can be used as a lubricant if grease is unsuitable due to the nature of the liquid passing through the cock. For cocks made of chemical stoneware, lubrication is especially desirable, as there is sometimes a noticeable tendency for the plug to seize in its seating, and any attempt to loosen it by tapping

from beneath may involve either damage to the cock itself or a hazard to the operator. Safety devices, however, are now obtainable for stoneware cocks to ensure that the plug can be loosened sufficiently for "easy turning" without any risk of the clearance being large enough to allow liquid to escape; the value of such cocks is appreciated to the full upon pipe-lines conveying acids or any liquid under pressure.

Coatings of sprayed metal provide a convenient means to reduce maintenance costs in particular circumstances. For instance, a fan wheel may be protected from corrosive fumes by a stainless metal sprayed upon the base metal. To-day, it is possible to deposit such a coating in copper, steel, nickel, certain nickel alloys and acid-resisting bronzes, in addition to lead, zinc, tin, aluminium or any other soft metal. The cost involved will often prove to be much less than that occasioned by continual replacements due to exceptional conditions of corrosion. Sprayed metal is also an advantage where worn parts have to be built up and again put into service to save the excessive expense of purchasing new equipment. Sprayed metal has been widely adopted for the reduction of maintenance costs in the United States. The sprayed coating has a density somewhat less than the actual metal used, due to its crystalline structure, but the Brinell hardness is about one-third higher due to air quenching. The coating may be built up to any desired thickness, and machined or ground and polished as desired.

* * *

An excessive amount of oil upon a power transmission belt will cause the belt to slip upon the pulleys, although the oil may not be otherwise damaging to the belt. The loss of power which results is directly proportional to the amount of "slip," and the percentage of power which is lost is also reflected as a production loss for the process which is concerned. Belting which is badly soaked with mineral oil can be degreased and then redressed with animal oil, and so restore the pliability of the leather without internal damage. Mineral oil removes the film of natural animal lubricant upon a leather belt, which will then develop cracks from the internal abrasion of the leather fibre. While power loss is a matter of concern, and cracking and internal abrasion involve high replacement costs, the burning of a leather belt by excessive slip can be far more serious, and this is an aspect of maintenance which must be considered very closely where there are a considerable number of belts in use. If the splattering of oil upon a belt is carefully avoided it will not be necessary to clean the belt periodically; the alternative course is to use a belt which is immune from harm by mineral oil as far as that is possible, and then clean it at regular intervals. Belts may be conveniently cleaned by brushing them with a stiff broom after laying them flat upon dry sawdust; sometimes it may be found necessary to give the belt a preliminary scraping with a broad putty knife. After brushing the belt is packed in fuller's earth or powdered chalk and then kept in a warm place to aid the absorption of the oil. The dry belt is finally lubricated with belt dressing, preferably a dressing which has been specifically recommended by the manufacturer of the belt. Pulleys which have become "oil soaked" in the sense of having collected considerable oily dust and dirt should also be degreased, as they also contribute to poor power transmission.

* * *

Leakage in a sulphuric acid pipe-line can be troublesome and also decidedly dangerous. In many cases the acid is necessary for the continuous operation of the process and quick methods of repair are needed. For temporary purposes it is possible to apply a patch of soft rubber, asbestos or soft lead, secured by the aid of pipe clamps from the fitters' store; alternatively, rope asbestos may be wound tightly round the pipe and then treated with sodium silicate. Repairs effected in this way will often last a considerable time depending upon temperature conditions and the concentration of the acid, but it must be remembered that their life is definitely limited and a speedy repair of permanent nature is very desirable. Permanent repair of distinctly novel type can be made by fitting a short 6 in. length of a

larger pipe cut in half lengthwise (for instance, a 4 in. pipe to meet the case of a leak upon a 3 in. pipe) with the aid of a layer of acid-proof cement mixed to the consistency of putty. The two halves of the larger pipe merely form a protective sleeve on the outside of the acid-proof cement patch, which extends completely round that portion of the pipeline which is affected, and they are secured by the aid of a permanent form of pipe clamp which will not be cumbersome. Such a repair will be ready to give permanent service within twenty minutes from completion. The method may be adopted for any pipe-line provided that a suitable acid-resistant cement is available to suit the nature of the liquid which is passing through the pipe. In the case of a liquid other than sulphuric acid it may be necessary to harden the set cement by the external application of dilute sulphuric acid.

* * *

The underground corrosion of pipes is generally the result of corrosive conditions in the soil; serious corrosion seldom occurs in a soil which has a high pH value and which is well drained. The occurrence of a leak in a buried pipe by external corrosion of the pipe calls for the necessity to examine other pipes in the immediate vicinity, which are likewise buried in the same kind of soil. Further evidence of corrosion may point to the soil as the main cause, but it is wise to investigate whether or not there are stray electrical currents. Protection against electrolytic action may be secured by lowering the potential of a network of buried pipes by means of a superimposed current; this is known as cathodic protection. The addition of slaked lime to limestone soils, and of calcium hydroxide to acid soils, has been suggested as a means for producing a protective film upon the bare pipe, but, due to the varying nature of soils in general, preliminary investigation is necessary to ascertain if a film of protective carbonate will be formed. Soils which contain lime and are poorly drained generally prove to be very corrosive, as compared with soils which are well aerated. In most cases it will be found more economical to protect buried pipes suitably, rather than use corrosion-resisting pipe material.

* * *

The fitting of a new safety valve demands due consideration that the area of the valve is ample to meet circumstances which may arise on the vessel to which it is fitted. Changes in working conditions may have taken place since the previous safety valve was fitted; alternatively, the new valve may be of a different pattern. Assurance must be obtained that the valve and its seating are made of a material which is not liable to corrode under actual conditions of plant operation. It is also necessary to be sure that a valve will actually blow off at the pressure indicated, and this necessitates testing the valve at least once a month, possibly more frequently, according to the nature of the plant, by easing up the weight or the spring. A safety valve which does not work freely is perfectly useless and should be replaced with all convenient speed in order to avoid a possible accident, for accidents due to pressure show a peculiar coincidence of taking place just when the safety valve has been overlooked in the routine of inspection by the maintenance staff. Vacuum-release valves are also important and must be of ample area when fitted to closed vessels handling steam or other vapour which is easily condensed, for the accidental admission of cold water to such a vessel will cause rapid condensation, and either the vessel or its cover may collapse if air cannot pass in quick enough by way of the vacuum-release valve.

NEW regulations of the Finnish Health Ministry relating to use of disinfectants by the general public, prohibit the use of mercury sublimate and considerably restrict the use of formaldehyde. Chloramine is now specified in place of sublimate and is recommended for hand disinfection and cleansing of utensils, etc. Large-scale disinfestation work is to be carried out with bleaching powder and slaked lime, while vermin destruction will be effected with hydrocyanic acid, ethylene oxide and sulphur dioxide.

Society of Public Analysts and Other Analytical Chemists

Discussion on Fe, P and Ca Compounds in Nutrition

A JOINT meeting of the Society of Public Analysts and Other Analytical Chemists with the Food Group of the Society of Chemical Industry was held on February 1, in the Chemical Society's Rooms, Burlington House, W.1. At the invitation of Dr. E. B. Hughes, vice-chairman of the Food Group, Professor W. H. Roberts, President of the Society of Public Analysts, occupied the chair. The following were elected members of the Society of Public Analysts and Other Analytical Chemists: G. Carter, B.Sc., A.I.C.; O. B. Darbshire, B.Sc., A.R.C.S., D.I.C., A.I.C.; F. M. Dyke, B.Sc., F.I.C.; A. A. Eldridge, B.Sc., F.I.C.; Professor F. Feigl, Dr. Ing.; G. H. Fraser; M. B. Ichaporis, M.Sc., Ph.D., A.I.C.; R. Porter; A. C. Ratcliff, B.Sc.; W. H. Templeton, B.Sc., F.I.C.

The subject discussed at the meeting was "The Analysis and Differentiation of the Composition of Iron, Phosphorus and Calcium Compounds in respect of Nutritional Requirements." Professor J. C. Drummond introduced the subject, iron compounds were dealt with by Dr. C. A. McCance, phosphorus compounds by Professor H. D. Kay, and calcium compounds by Dr. J. D. Robertson in place of Professor E. C. Dodds, who was unable to be present.

Professor Drummond referred briefly to the development of methods of assessing nutritional value since the pioneer work of Liebig. To-day the mere determination of the total intake of iron, phosphorus and calcium was insufficient. For example, the nutritional value of iron in red meat was very different from that of the iron in wheat, and methods of estimating "availability" of the iron had assumed great importance. The problems arising in connection with phosphorus and calcium were in many respects closely inter-related and had an important bearing on the function of vitamin D. It appeared that at the present time the average intake of calcium, and the Ca/P ratios of diets, were lower than formerly and considerably below the optimum values, and this fact might account for the frequent necessity of supplementing the normal intake of vitamin D, by the use of certain rich sources of this vitamin which formerly was neither necessary nor available.

Dr. McCance, speaking on iron in relation to the subject under consideration, pointed out that this metal in the ionisable form, e.g., as mineral salts, was utilisable by the animal body to a much greater extent than the iron in organic combination in haemoglobin or haematin. Since 1930 a means of discriminating between these two forms of combination of iron by means of $\alpha\beta'$ -dipyridyl, which determined the former, but not the latter state of combination, had come into use. Valuable as this method was, a critical examination of the results obtained with it, compared with the results of biological assays, showed many wide and variable discrepancies. Probably the use of tripyridyl was preferable to that of $\alpha\beta'$ -dipyridyl, and there was room for great improvement in the methods of biological assay used in this work. It would seem that the iron not determined by $\alpha\beta'$ -dipyridyl could not be entirely accounted for as haemoglobin or haematin, and the nature of the fraction not accounted for had not yet been ascertained.

Professor Kay pointed out that in certain respects the nutritive values of phosphorus and calcium were interdependent. The different forms of combination in which phosphorus occurs in foodstuffs were classified and their mode and degree of absorption discussed. The presence of precipitants for phosphates in the food ingested might seriously interfere with absorption of phosphorus. This was strikingly shown by recent experiments on the effect of ingestion of beryllium carbonate, which, owing to the practically complete insolubility of beryllium phosphate, was able, when present in certain quantities, to prevent absorption of phosphates present

(Continued on foot of next column.)

Workmen Injured by Chemicals

Action for Damages Settled—Dangers Unknown to Employers

TWO chemical works employees (Mr. E. L. Lee and Mr. S. S. Radford) are to receive a total of £8,500 under a settlement in two consolidated claims for damages for alleged negligence from their employers, the Leyton Manufacturing Co., Ltd., announced before Mr. Justice Lewis in the King's Bench Division on Monday.

Mr. Cartwright Sharp, K.C., for the plaintiffs, in announcing the settlement, said that it had been agreed that the defendants should pay Mr. Lee £3,500 and Mr. Radford £5,000. The plaintiffs were workmen employed by the defendants, who were manufacturers of chemicals. He did not think that there was now any doubt that, owing to the vapours from certain chemicals, grave personal injury was inflicted on the plaintiffs. It was a moot point whether that was due to negligence on the part of the defendants. Radford was in a terrible state. Lee would probably never be able to work again. He (counsel) would not have been willing to agree to the sums which were to be given as compensation if there had been no question of liability. In view, however, of the fact that there was a serious dispute as to liability, those advising the plaintiffs had unanimously determined that the defendant company's offers ought to be accepted as being in the plaintiffs' interests.

Replying to his Lordship, Mr. Cartwright Sharp said that the negligence alleged against the defendants was failure to take sufficient steps to protect the men from dangerous chemical vapours.

Mr. H. J. Wallington, K.C., for the defendants, said that the defendant company was anxious that no harm should come to its workmen. Before beginning the manufacture of the particular chemicals in question the company made exhaustive inquiries in Germany and in America through the Home Office about the possible effects which those chemicals might have on workmen. As a result of those inquiries the defendants thought that there was no danger, but still they took steps to protect the men from the vapours. Even when something appeared to be going wrong with some of their employees the company's medical advisers were unable to find that the trouble was due to anything at which the men were working. In view of the fact that there was grave doubt whether the defendants were negligent their offer to the plaintiffs could be described as generous.

Mr. Justice Lewis, consenting to the terms of the settlement, said that it looked to him as though the defendants would have had a very good defence to the plea of negligence, for an employer could only be expected to do what was reasonable by way of taking precautions.

β -butylene ($\text{CH}_2\text{CH}:\text{CHCH}_3$) is reported to give an extremely high temperature on burning which renders it very suitable for use in an oxy-blowpipe for steel cutting. Practical limit is found in steel pieces of over 300 mm. thickness. The gas should be heated to about 40° C. before being burned and the blowpipe should have a fairly large nozzle.

(Continued from previous column.)

in the food almost completely, and so give rise to rickets even with normal diets rich in vitamin D. A similar precipitating action on phosphates no doubt would account for the known fact that the presence of a large excess of calcium in a diet interferes with phosphorus absorption. A recent promising method of studying phosphorus absorption and metabolism was described, based on ingestion of artificially produced radio-active phosphorus of atomic weight 32. This was indistinguishable chemically from ordinary phosphorus, but it could be determined by means of its radio-active properties and some interesting results obtained by this method of investigation were mentioned.

Safety Glass Patent Action

Claim for Damages Fails

MR. JUSTICE BRANSON, in the King's Bench last week, gave his considered judgment in a claim for damages for alleged breach of contract and conspiracy concerning a process for the manufacture of "toughened" safety glass made by Gilt Edge Safety Glass, Ltd., of Stone, Staffordshire. (See *C.A.*, January 21, page 42; January 28, page 63.) Defendants, who denied the allegations, were Mr. Granville Hugh Baillie, consulting engineer, of Westminster; Pilkington Brothers, glass manufacturers, of St. Helens; Triplex (Northern), Ltd., of St. Helens; and Messrs. James Meikle, Robert Francis Taylor, Lewis Jex-Blake Forbes, and John Dennett. Breach of contract was alleged by plaintiffs against Pilkingtons, and conspiracy against the other defendants. For Gilt Edge Safety Glass, Ltd., it was stated that in 1935 the company desired to operate a process in the manufacture of toughened safety glass. To ascertain whether its process infringed any patent of Pilkingtons, it was decided there should be a confidential inspection by Pilkingtons' technicians. That took place in June, 1935. Plaintiffs alleged that information of the process was circulated to rivals, and had found its way into the patent specifications of Pilkingtons. This was denied by Pilkington Brothers.

In his judgment, Mr. Justice Branson said that in his view plaintiffs had failed to establish a contract, and if there were no contract there were no terms to be implied. It was said, further, that there was an obligation upon Pilkingtons to treat matters they saw at the inspection as confidential. There was no evidence that they had used any information they might have obtained in their own patents.

"The view I have formed is that there were no contractual or confidential relations between the parties in connection with the inspection," said Mr. Justice Branson. "The next question is whether there was a breach of confidence by defendants. That matter becomes immaterial in view of the finding I have reached that there was no contract between the parties. Further, I decline to spend much time over the question of Mr. Dennett being present at the inspection."

Another allegation was that the defendants, acting together, made use of information obtained at the inspection to draft a specification and enlarge its scope to cover the plaintiffs' specification and use it for commercial advantages. He had considered all the correspondence and documents, and it was impossible to construe them as involving any agreement by Pilkingtons to disclose every one of the patents relating to toughened glass. Therefore, that cause of action failed.

"That leaves the allegation of fraudulent conspiracy to injure. This allegation has been set up in one part of the statement of claim, and it is said that the conspiracy was to induce Pilkingtons to break the contracts which have been alleged. I can deal with this point shortly. I have found that the defendants were not helped in the drafting of their complete specification by anything they learnt at the inspection, and I have found that there was no contract for the disclosure of their patent. I have found there was no such contract, and, if there was, there was no breach of it. Thus the basis of a conspiracy to injure, or a conspiracy to induce a breach of contract, has disappeared. For these reasons the action fails on every point, and I enter judgment for defendants, with costs."

A NEW calcium cyanamide factory is being built by the Stockholms Superfosfat A.-B. at Stockvik and is expected to be completed in 1941 at a total cost of 5 million kronen. Intended to replace the out-of-date factory at Alby, the new works will possess an annual output capacity of 40,000 tons calcium cyanamide or more than twice that of the Alby works. The company is reported to have experienced a satisfactory year's trading in 1938, and an unchanged dividend of 8 per cent. is anticipated.

RECENT TRADE LITERATURE

Restlight glass, which when used as a filter in the ordinary electric bulb, eliminates the injurious effects of artificial light, forms the subject of a brochure issued by RESTLIGHT, LTD. It is claimed that Restlight, which was invented by the inventor of Vita glass, absorbs all harmful excess of red from artificial light in that it "corrects" artificial light by balancing the spectrum. The brochure contains illustrations of offices and works where Restlight has been installed.

STERNOL, LTD.'s, latest poster issued in connection with Sternocleanse antiseptic cream, is intended for fixing to works notice boards in order that workmen may be encouraged to make full use of Sternocleanse provided by the management as a means of protection against dermatitis and other forms of skin trouble. The company have also issued a descriptive leaflet of the preparation in which it is stated that Sternocleanse is a smooth antiseptic cream that seals the pores of the skin against the entry of any irritant.

The 45th issue of the "Towers Messenger," organ of J. W. TOWERS AND CO., LTD., Widnes, contains descriptions of apparatus suitable for use in connection with the revised "Standard Methods for Testing Tar and Its Products," a new edition of which was published recently by the Standardisation of Tar Products Tests Committee. Specifications are given of thermometers, density hydrometers, specific gravity hydrometers, sulphonation apparatus, phenols separating apparatus, etc. The company has also issued a booklet which gives an impression of some of their specialities.

A series of four-page leaflets illustrating examples of work executed by S. BRIGGS & CO., LTD., Burton, has been issued by the company. The leaflets deal with copperwork, steel plate work (riveted and welded), aluminium plant, wood tanks and equipment in stainless steel supplied to the chemical, brewery, dairy and food product industries, etc. The plants illustrated include a battery of pressure boiling vessels, a pulp filter constructed with plates in aluminium silicon alloy, part of a battery of 25 6,000-gallon wood tanks with welded copper linings and steam-jacketed mixing vessels.

CROFTS (ENGINEERS), LTD., have issued a new catalogue, S.G. 138, which deals with Stock V-Rope Drives. In addition to illustrations of plant to which Stock V-Rope Drives have been applied, the catalogue contains comprehensive tables which enable the most efficient and economical drive for any given power and speed to be immediately determined, and prices arrived at, without the necessity of calculations of any kind. The most suitable combination of pulleys and ropes, for given horse powers and centre distances, are also listed. The range of Stock V-Rope Drives detailed are in sizes to meet all general industrial requirements, for powers from fractional up to 100 h.p., and for all ratios up to 8 to 1.

A considerable amount of fresh matter has been added to the latest edition of the Abralac synthetic resins and Abrac ester gums booklets issued by A. BOAKE, ROBERTS AND CO., LTD. Abralac P. is an almost colourless synthetic resin which does not darken on exposure but is actually decolourised by sunlight. It is soluble in a wide range of organic solvents and mixtures of solvents and it can be supplied either as the solid resin or dissolved in solvents such as methylated spirit or acetone, or a mixture of 80 per cent. ethyl acetate and 20 per cent. alcohol. Abralac P.H. is a hard form of Abralac P., melting at 90° C., to which it is similar in nearly all respects. Abralac B.G. is a new synthetic resin possessing a high degree of solubility in almost all of the solvents normally used for cellulose ester lacquers and having the unique and valuable property of being completely compatible with cellulose nitrate in all proportions. Formulae using the different grades of Abralacs with cellulose nitrate or acetate are given. The Abrac ester gums booklet describes the properties and uses of these high-grade products of low acidity.

Personal Notes

MR. ALFRED BISHOP, of Wimbledon, manufacturing chemist, has left estate valued at £44,472 (net personality £38,399).

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MR. JOHN WILSON HOPE, former chairman of John Knight Ltd., Silvertown, left estate valued at £184,338 (net personality £182,608).

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LORD FORTEVIOT, of Dupplin, chairman of the Distillers' Co., Ltd., has been re-elected president of the Perth branch of the British Legion.

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MR. F. J. LEATHERS, deputy-chairman of Wm. Cory and Sons, has been elected an additional director of the Tunnel Portland Cement Co., Ltd.

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DR. FRANCIS W. GOODBODY, lecturer in medical chemistry in University College, London, left estate valued at £19,678 (net personality £19,263).

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MR. GILBERT C. LONGSTAFF has resigned from the office of chief managing director of Blundell, Spence and Co., Ltd., paint and varnish manufacturers.

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MR. D. R. C. PHILIP, for many years general sales manager of John Dewar and Sons, Ltd., distillers, of Perth, has been appointed a director of the firm.

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MR. FRANCIS CHARLES HILL, a director of Associated Lead Manufacturers, Ltd., and Colombo Lead Mills, has left estate valued at £69,865 (net personality £66,939).

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MR. W. ROBSON BROWN, formerly managing director of the Old Castle Iron and Tinplate Co., has been appointed general manager of Richard Thomas and Co. He joined Richard Thomas in 1936.

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LORD FALMOUTH, who is a member of the Advisory Council of the Department of Scientific and Industrial Research, opened the British Pottery Research Association's new laboratories at Penkhull, Stoke-on-Trent, last week.

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MR. JOHN WILLIAM IVORY, managing director of Job Ivory and Co., Ltd., Liverpool, oil merchants, importers and refiners, was elected president of the Seed, Oil, Cake and General Produce Association, at a meeting of the Council held at Liverpool on Tuesday. He was chairman of the Whale Oil and Fish Oils Committee for several years, became chairman of the General Produce Executive Committee in 1936, and was appointed vice-president of the Association last year. MR. E. E. BILLINGTON, B.Sc., M.Sc., F.I.C., M.I.Struct.Eng., a former president of the Seed, Oil and Cake Trade Association, was elected vice-president, and COT. A. M. McGILCHRIST (Meade-King, Robinson and Co., Ltd.), and MR. JOHN MORETON (Langlands, Lewis and Robinson) were elected chairmen of the General Produce and Feeding Stuffs Sections, respectively.

OBITUARY

MR. JOHN ERNEST HOWARTH LOMAS, joint managing director of the Rhodesia Copper and General Exploration Co., died last week at the age of 71.

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SIR HENRI DETERDING, who, for many years until his retirement at the end of 1936, was general manager of the Royal Dutch Shell group of companies, died at St. Moritz, Switzerland, on February 4, at the age of 72.

TO-DAY'S ANNIVERSARY

JOSIAH WILLARD GIBBS, who developed the application of thermo-dynamics to chemistry, was born on February 11, 1839. His announcement of the Phase Rule was made in 1878, work which led up to this having been commenced in 1873 and published in a rather obscure American journal, *Transactions of the Connecticut Academy*. Some of the conclusions which were reached by Gibbs were made independently by other investigators at a later date. It was not until 1887 that the Phase Rule and its utility in physical chemistry became generally known through Roozeboom, who was investigating the hydrates of sulphur dioxide at Leyden and had his attention drawn to the work of Gibbs by van der Waals. Gibbs also gave attention to thermal dissociation, surface tension and electro-chemistry, and developed an equation connecting adsorption and interfacial tension. He died in 1903, having held the post of professor of mathematical physics in Yale University.

Foreign Chemical Notes

Jugoslavia

WITH A CAPITAL OF 10 MILLION DINAR, the Me-Ba Concern has been formed at Agram to engage in the manufacture and processing of various plastic materials.

Italy

ANILINE POISONING IN ANIMALS has been found to be counteracted by immediate injections of lecithin and cholesterol (C. Bellesini, *Medicina Lavoro*, 29, 104).

THE MILAN FIRM OF DOMENICO POSTIGLIONE is planning to commence the manufacture of heptaldehyde, undecylenic acid and various derivatives of the latter.

Holland

A NEWCOMER TO THE SYNTHETIC TEXTILES INDUSTRY is announced in the N. V. Algemeene Kunstvezel Mij of the Hague, with a capital of 500,000 guilders (of which 150,000 are paid up).

THE ASSOCIATION OF DUTCH STRAWBOARD MANUFACTURERS has decided to establish a research institute which will examine the possibilities of utilising straw for other purposes than cardboard manufacture.

France

ABOUT 1,000 WORKERS ARE EMPLOYED at the recently opened Lanital factory at Wasquehal which has now commenced production with a daily capacity of 2 tons, later to be increased to 8 tons.

UTILISATION OF AGRICULTURAL WASTE PRODUCTS for furfural manufacture has been urged with a view to cutting down the consumption of phenol by the synthetic resin industry. A particularly promising raw material for furfural is reported to be the residues of cider manufacture.

Japan

A TANTALUM ORE DEPOSIT with an estimated content of 600 tons metal has been discovered in the North Heian province of Korea.

A SULPHURIC ACID FACTORY on the island of Formosa, with a capacity of 50 tons, has just been completed by the Taiyo Kogyo K.K., who are employing the Matsui-Osame contact process. Several other concerns are planning the construction, or are already engaged in the construction, of plants operating the same process which uses exclusively Japanese raw materials and will mean an addition to the sulphuric acid production capacity of the country of 400 tons per day within the next 12 months.

General News

THE WORKS AND OFFICES of the Scottish Enamelling Co., Ltd., at Larbert, were completely destroyed by fire on February 4. The cause of the fire is unknown.

ACCORDING TO A STATEMENT issued by the Mines Department, 928 persons were killed by accidents in mines and quarries in Great Britain in 1938, compared with 961 in 1937 and 878 in 1936.

AN INCREASE compared with a year ago of 600 overseas buyers in the number coming to the British Industries Fair this month has been announced by the Department of Overseas Trade. The greatest increase to date is from Holland, which is sending 607 as against 465 last year.

THE ADVISORY PANEL OF INDUSTRIALISTS, which was constituted to receive representations and to make proposals in regard to the execution of the rearraignment programme, stated in its first report that it had had a discussion and received memoranda from Sir Frank Smith in connection with the production of synthetic oil.

AS THE RESULT OF A NEW AGREEMENT between most of the leading salt manufacturers—including Imperial Chemical Industries, Ltd.—Cerebos, Ltd., has raised its prices to the retail trade by about 10 per cent., for certain kinds of salt. Though co-operation has existed between the principal salt manufacturers for some years, the agreement which came into force at the beginning of this year is much firmer than any previous agreement in the industry.

MR. H. V. POTTER, managing director of Bakelite, Ltd., stated in his second Keith lecture at the Heriot-Watt College, Edinburgh, last week, that the present consumption of plastics in Great Britain was about 1-lb. per head of population, while in Germany the consumption per head was half as much again. Despite the wide field of use that plastics had already opened up, he felt that the industry was still in its early infancy, and would undoubtedly assume an ever-increasing importance in everyday life for many years to come.

THE TREASURY, on the recommendation of the Import Duties Advisory Committee, made an order providing for the addition to the free list as from Thursday, of alloys of metal, unwrought in blocks, ingots, cakes, bars, and slabs, containing more than 50 per cent. by weight of bismuth and more than 15 per cent. by weight of lead. Bismuth metal is already exempt from duty. Difficulties have recently arisen in obtaining adequate supplies of ores, and it is now desired to import material in the form of an alloy for refining.

ACCORDING TO PRELIMINARY ANNUAL FIGURES issued by the United States Department of the Interior (Bureau of Mines) the most important items in foreign trade in lead and zinc pigments for the first 11 months of 1938 (12 months' figures for 1937 shown in parentheses) were as follows: Exports of white lead (dry and in oil) amounted to 1,271 (1,236) short tons, litharge 1,605 (1,452) tons and red lead 747 (934) tons. Imports of lithopone during the same period totalled 3,585 (5,601) tons, dry zinc oxide 546 (680) tons and zinc oxide in oil 60 (95) tons. Exports of lithopone amounted to 1,646 (2,671) tons and of zinc oxide to 1,079 (2,953) tons.

THE COMBINED IMPORT AND EXPORT TRADE OF CHEMICALS and allied products of all European countries (excluding Spain) exceeded \$1,525,000,000 in 1937. Of this total, \$850,000,000 represented chemical exportations and \$675,000,000 importations. These figures are based on compilations made from the official foreign trade returns of the respective countries for the year 1937 (the latest available) by the U.S. Department of Commerce. Of the European exports, Germany accounted for 37 per cent., the United Kingdom 17, and France 12. Belgium, the Netherlands, Switzerland, Norway, with \$23,000,000, and Italy were the other important exporting countries in this area. These eight countries being such important world suppliers of chemical products naturally import a much smaller proportion of necessary materials and accounted for a smaller share of the total import trade. The United Kingdom was the largest importer (over \$120,000,000) followed by Germany, (\$80,000,000), and France (\$70,000,000), the Netherlands (\$55,000,000), Belgium (\$45,000,000), Sweden (\$40,000,000), Italy (\$35,000,000), Switzerland (\$25,000,000), Czechoslovakia (\$25,000,000) and Denmark (\$20,000,000).

From Week to Week

IT IS REPORTED that the Anglo-American Oil Co.'s first well near Dalkeith, Scotland, is now producing at the rate of 30 barrels of oil a day and that it may be considered a commercial proposition at the moment.

THE FRENCH "JOURNAL OFFICIEL" of January 27, contained an order, dated January 25, which fixed the quota for the import of crude iodine (Tariff No. 055) into France during the first three-quarters of this year at 20,000 kilogs.

AN ALUMINIUM ALLOY WORKS is to be established at Cardiff by International Alloys, Ltd. The City Council this week approved the sale of twenty acres of land for the erection of a factory and gave the company an option over another forty acres for fifteen months.

B.S. SPECIFICATION NO. 7 (Rubber-Insulated Cables and Flexible Cords) probably one of the most well-known of all the British Standards used in the electrical industry, has been revised by the British Standards Institution. It has undergone several revisions since its first issue in 1904, but the revision that has just taken place is of a more far-reaching nature than any previously.

T.M. THE KING AND QUEEN paid an informal visit to the National Physical Laboratory at Teddington on Monday. Their Majesties were welcomed by Lord Rayleigh, chairman of the executive committee of the laboratory. With Dr. C. G. Darwin, the director, and Prof. E. V. Appleton, Secretary of the Department of Scientific and Industrial Research, they made an extensive tour of the premises.

THE WORKS OF THE RHEOSTATIC CO., LTD., Slough, were damaged by fire on February 4, but the main parts of the valuable machinery were saved and production plant unaffected. The fire, which was accompanied by explosions due to the bursting of oil drums, was put out within two hours. The Rheostatic Co., are makers of thermostats and thermostatic controls, a large number of their productions being in use in the chemical industry.

THE CHAIRMAN OF THE HULL AND DISTRICT SEED CRUSHERS' ASSOCIATION (Mr. Cecil H. Robson) reports that arrivals of oilseed and nuts into Hull during 1938 represent between 40 per cent. and 45 per cent. of all the imports of this class of raw material into the United Kingdom. Hull's position as a leading oil manufacturing centre has been strengthened during the year by the opening of a large mill on the River Hull for the production of refined whale oil and edible products.

IN THE CHEMISTRY SECTION OF THE ALL-INDIA SCIENCE CONGRESS held last month, Professor M. N. Goswami, head of the Applied Chemistry Department of Calcutta University, gave details of his recent investigations into the preparation of synthetic resins from oils. The oil used can be any kind of vegetable or animal oil, and even oil sludges, and the oil is heated with a catalyst for three to four hours when the oil becomes solidified. The cost of production is said to be as low as ½d. per pound. Professor Goswami's Indian patent has been accepted and he has applied for foreign patents in England, U.S.A., Germany, Japan and Norway.

THE VICE-CHANCELLOR OF BIRMINGHAM UNIVERSITY, in proposing the toast of "Chemistry" at the annual dinner and dance organised by the Midland Chemists' Committee last week, stated that the feature of the last quarter of a century had undoubtedly been the way in which chemistry had advanced in the sphere of the unknown. The fact was that to-day our activities were getting out of step and we were amassing knowledge at a fearful rate without knowing how to use it. They could not blame chemists and physicists for that state of things. He was tempted by their success in their own particular job to wish that they could bring about some moral rearmament or spiritual revival. That was what was wanted more than anything else to-day. Mr. W. A. S. Calder (president) responded and stressed the need for a strong united body in the industry and asked for support for efforts being made in that direction.

Books Received

Systematic Qualitative Organic Analysis. By H. Middleton, London: Edward Arnold and Co. Pp. 279. 8s. 6d.

New Companies Registered

H. Barker and Co. (Chemists), Ltd. 347,978.—Private company. Capital £500 in 500 shares of £1 each. To carry on the business of consulting, analytical, manufacturing, pharmaceutical and general chemists, etc. Directors: Joshua Weston, "Blaenau," 286 Uppingham Road, Leicester; Howard Barker.

Margetts (Chemists), Ltd. 348,142.—Private company. Capital £100 in 100 ordinary shares of £1 each. To carry on the business of manufacturing, analytical, dispensing and advising chemists, etc. Directors: Russell R. Margetts, 179 Loughborough Road, West Bridgford, Notts.; Mrs. Doris L. Margetts.

Warsto Products, Ltd. 348,017.—Private company. Capital £500 in 500 ordinary shares of £1 each. To carry on the business of shellac, gum, wax, glue and chemical merchants, manufacturers of white lac, manufacturing chemists, etc. Directors: John L. Warne, 272 Baring Road, Grove Park, S.E.12; Benjamin C. Stone. Registered office: 30 Bush Lane, Cannon Street, E.C.4.

Textol, Ltd. 20,754.—Private company. Registered in Edinburgh. Capital £1,000 in 1,000 shares of £1 each. To carry on the business of manufacturers of or dealers in all kinds of emulsions, oil, wax, fat, glue, rubber, polish, soap, etc. Directors: John M. Wilson, 12 Third Gardens, Dumbreck, Glasgow; James N. Williams; John McGougan. Registered office: Hillington Industrial Estate, Hillington, Glasgow.

Carmac Laboratories (1938), Ltd. 347,813.—Private company. Capital £1,500 in 10,000 ordinary shares of 1s. each, and 1,000 6 per cent, cumulative preference shares of £1 each. To carry on the business of manufacturing, pharmaceutical and general chemists, etc. Subscribers: Mrs. Dorothy E. S. Smith, 56 Elmwood Road, W.4; Robert S. Swanton. Registered office: 163 High Street, Hampton Hill, Middlesex.

Tomloy Chemical and Engineering Co., Ltd. 348,198.—Private company. Capital £2,000 in 4,000 shares of 10s. each. To carry on the business of chemical, electrical, mechanical, civil, naval, aeronautical and experimental engineers and contractors, manufacturers of and dealers in chemicals, dyes, paints, varnishes, bakelite and other moulding compositions, etc. Directors: Otto Lowy, Bucharest, Strada Gogu Cantacuzino 61; Gabriel Porosz. Registered office: 5-6 Princes Street, Cavendish Square, W.1.

General Products Corporation (Chemicals), Ltd. 347,610.—Private company. Capital, £1,000 in 500 6 per cent, cumulative preference shares of £1 each and 2,000 ordinary shares of 5s. To carry on the business of manufacturers of and dealers in soaps, disinfectants, chemical compounds and preparations, chemists, druggists, dealers in patent and proprietary medicines, drysalters, distillers, manufacturers of and dealers in toilet requisites, etc. Directors: Charles E. Simpson, 18 Tatton Road South, Heaton Moor, Stockport; Barbara S. Thomson; Stuart J. Harris. Registered office: 58 Grosvenor Street, Manchester.

Abco Products, Ltd. 347,997.—Private company. Capital £1,000 in 1,000 ordinary shares of £1 each. To acquire certain patents relating to powders for use with molten metals and the registered trade marks Abco, Beta and Besco, and to carry on the business of manufacturers of and dealers in chemical substances for use in refining metals, surface hardening compounds, soldering flux, etc. Directors: Leonard M. E. Dent, 2 Porchester Gardens, W.2; Hester Dent. Registered office: Coventry House, South Place, E.C.2.

Tonerde, Ltd. 349,036.—Private company. Capital £50,000 in 50,000 shares of £1 each. To carry on the business of manufacturers of and dealers in coke oven products and by-products of all descriptions, dealers in fuels, mineral oils, chemicals and fertilisers, metallic and other oils, minerals, ferrous and non-ferrous metals, precious metals, rubber, wood, timber, pulp and generally all industrial, chemical and pharmaceutical raw materials, manufacturers of and dealers in rayon, silk and artificial silk, wool, cotton, flax, hemp, jute, cellulose, viscose and any other filamentous or fibrous materials, etc. Subscribers: James A. Stewart, 18 Austin Friars, E.C.2; William Ritchie.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

South Africa.—H.M. Trade Commissioner at Johannesburg reports that the Johannesburg City Council is calling for tenders for the supply and delivery, as and when required to any municipal workshop, store depot, or crusher station, for a period of twelve months from June 1, 1939, of quantities of oils and greases. Tenders endorsed "Contract No. 177—Oils and Greases" should be addressed to the Town Clerk, Municipal Offices, Johannesburg, South Africa, by whom they will be received up to noon on Saturday, March 18, 1939. Samples of the oils and greases offered must be delivered to the Mechanical Engineer, Mechanical Workshops, cor. Market and Goch Streets, Newtown, not later than the time and date of closing of tenders. A copy of the specification and conditions of contract may be inspected at the Department of Overseas Trades.

Egypt.—H.M. Consul-General at Alexandria reports that the Ports and Lighthouses Administration at Alexandria is calling for tenders for the supply and delivery of paints and varnishes, including paints in oil, paints in paste, dry paints, varnishes, compositions, tallow and tar, etc. Tenders due in Alexandria by March 14, 1939. (Ref. No. T.Y. 18130/39.)

Chemical and Allied Stocks and Shares

THE stock and share markets failed to continue the upward movement which developed last week, but the undertone was described as steady, and in most cases the higher prices recorded a week ago have been fairly well maintained. Various shares of companies connected with the chemical and kindred industries were inclined to attract rather more attention in view of the apparently generous yields offered and the more hopeful dividend estimates now current in the market.

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Imperial Chemical ordinary units were active, having remained under the influence of hopes that the distribution for the past year may be 8 per cent., and at the time of writing the price is 30s. 10½d., compared with 30s. 4½d. a week ago. Lever and Unilever at 33s. 3d. have failed to hold all their recent rally, and International Nickel, Swedish Match and most other shares with an international market were moderately lower on balance.

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On the other hand various shares of companies with important connections with home trade were favoured. British Oxygen, for instance, have moved up to 71s. 3d. at the time of writing, which compares with 67s. 6d. a week ago, while Murex were better at 75s. 7½d. British Aluminium strengthened from 53s. 9d. to 54s. 6d. partly owing to current market expectations that, despite the larger capital ranking, the dividend for the year may again be brought up to 12½ per cent. British Oil and Cake Mills preferred ordinary continued to attract rather more attention and made the slightly higher price of 41s. 9d. Fison Packard and Prentice were more active and were again quoted at 38s. 9d.

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Partly owing to the increased steel production figures for the past month, iron, steel and kindred shares were relatively steady. Stewarts and Lloyds were higher, as were Tube In-

vestments and Consett Iron. Colvilles and Baldwins were assisted by hopes that the forthcoming dividends may be maintained, while Firth and John Brown were also better in response to current dividend estimates. Cement shares attracted attention on reports that leading manufacturers are negotiating for the re-introduction of the quota arrangements which were in force in the industry up to the end of 1937. The market assumes that any development of this kind would limit production and thus reduce the danger of growing competition. As compared with a week ago Associated Cement ordinary units have moved up from 66s. 3d. to 70s., while British Portland Cement and Tunnel Cement were also higher on balance. British Plaster Board were a few pence better at 25s. 9d.

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Borax Consolidated declined 3s. to 22s. 6d., but are now "ex" the dividend of 7½ per cent. The latter compares with a total distribution of 10 per cent. for the previous year. Imperial Smelting have improved from 11s. to 11s. 6d., and Pinchin Johnson were a better market and have rallied to 26s. 3d., while International Paint and Indestructible Paint had a steady appearance, awaiting the dividend announcements.

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Boots Drug made the higher price of 40s. 3d. and Sangers at 20s. 9d. are within 3d. of the quotation ruling a week ago. Timothy Whites and Taylors were well maintained at 25s., and British Drug Houses were again 21s. 3d. Business around 21s. was recorded in the 5 per cent. preference shares of A. Boake Roberts and Co.

Leading oil shares were less active, but "Shell" and Royal Dutch were inclined to show further improvement. Rather lower prices were made by Anglo-Iranian and Burmah Oil. London and Thames Haven Oil shares were lower, pending the dividend decision.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

CONSOL PRODUCTS, LTD., Sunbury-on-Thames, essence and cordial manufacturers, etc. (M.S., 11/2/39.) January 28, £50 and £1,650 debentures, parts of a series already registered. *£7,900. April 11, 1938.

Satisfactions

BRITISH CELANESE, LTD., London, W. (M.S., 11/2/39.) Satisfaction January 31, of debenture stock registered August 24, 1922, and July 6, 1923, to the extent of £82,431.

UNITED STEEL COMPANIES, LTD., Sheffield. (M.S., 11/2/39.) Satisfaction January 28, of debenture stock registered October 25, 1934, to the extent of £41,000.

County Court Judgment

KNOTT, CHAS., Workshops C. and D., 20c Pimlico Road, S.W.1. (C.C., 11/2/39.) Manufacturing chemist. £62 17s. 9d. December 7.

Declaration of Solvency Filed

JOHN PICKERING AND SONS, LTD., Newcastle-on-Tyne. (D.S.F., 11/2/39.) Soap and candle manufacturers, etc. January 27.

Receiverships

AJOTAL, LTD., London, S.W., soap manufacturers. (R., 11/2/39.) D. D. C. Giddins, has ceased to act as receiver and manager. August 26.

FURMOTO CHEMICAL CO., LTD., London, S.W. (R., 11/2/39.) A. E. Middleton has ceased to act as receiver and manager. January 30.

Forthcoming Events

London.

February 13.—Royal Society of Arts. John Street, Adelphi, W.C.2. 8 p.m. Sir Gilbert T. Morgan, "Achievements of British Chemical Industry in the Last 25 Years."

Institution of the Rubber Industry. Northumberland Rooms, Northumberland Avenue, W.C.2. 7.30 p.m. Dr. P. Stöcklin, "Buna Rubber."

February 15.—Institute of Chemistry. School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1. Professor E. N. da C. Andrade, "The Viscosity of Liquids."

February 15-25.—Exhibition of Inventions. Royal Horticultural Hall, Vincent Square, S.W.1. 11 a.m. to 9.30 p.m.

February 16.—Sir John Cass Technical Institute. Jewry Street, Aldgate, E.C.3. 7 p.m. S. Judd Lewis, "Spectroscopic Analysis."

Royal Institution. 21 Albemarle Street, W.1. 5.15 p.m. C. G. Goodeve, "Photochemistry."

The Chemical Society. Burlington House, Piccadilly, W.1. 8 p.m. Meeting for the reading of original papers.

February 17.—Institution of Chemical Engineers. 17th Annual Corporate Meeting. 11 a.m. and 2.15 p.m. G. W. Hewson and R. L. Rees, "Selected Chemical Engineering Developments in Large-Scale Steam Generation." 7.30 p.m. Hotel Victoria, Northumberland Avenue, W.C.2. Annual Dinner.

February 18.—Royal Institution. 21 Albemarle Street, W.1. 3 p.m. Sir William Bragg, "Crystals of Organic Substances."

Finsbury Technical College Old Students' Association. Annual Dinner. Trocadero Restaurant. 7 p.m. Tickets price 12s. 6d. from the Hon. Secretary, H. P. Guy, 61 Station Road, New Barnet, Herts.

Aberdeen.

February 17.—Chemical Society. Marischal College. 6 p.m. Joint Meeting with the Aberdeen and North of Scotland Section of the Institute of Chemistry. Professor J. Kendall, "Ions and Isotopes."

Belfast.

February 14.—Institute of Chemistry. Royal Belfast Academical Institution. 7.30 p.m. Professor W. R. Fearon, "Diffusion Methods of Quantitative Analysis."

Birmingham.

February 14.—Institute of the Plastics Industry. James Watt Memorial Institute, Great Charles Street. 8 p.m. J. Butler, "Moulding Plastics—An Attempt to Cover the Compleat Art."

Bristol.

February 16.—Institute of Chemistry. University, Woodland Road. 5.30 p.m. Dr. T. J. Drakeley, "Recent Advances in Rubber Technology."

Glasgow.

February 17.—Chemical Society. Royal Technical College, 204 George Street. 7.30 p.m. Invitation to Society of Chemical Industry. Meeting for the reading of original papers.

Leeds.

February 13.—Institute of Chemistry. E. B. Maxted, "The Poisoning of Catalysts."

Manchester.

February 13.—The Institute of the Plastics Industry. Engineers' Club, Albert Square. 7.30 p.m. O. W. G. Doll, "Modern Injection Moulding."

February 17.—Society of Dyers and Colourists. 36 George Street. 7 p.m. J. Baddeley, "The British Dyestuffs Industry."

Sheffield.

February 15.—Society of Glass Technology. "Elmfield," Northumberland Road. 2 p.m. Ordinary General Meeting. Professor W. E. S. Turner, "The Glass Industry of America, 1938."

Stoke-on-Trent.

February 13.—British Ceramic Society (Pottery Section) North Staffordshire Technical College. 7.30 p.m. F. T. Wood and S. R. Hind, "Some Observations on Delayed Crazing."

Stourbridge.

February 13.—Society of Glass Technology (Midlands Section). Talbot Hotel, Th. Teisen, "The Relative Merits and Efficiency of Oil, Towns' Gas and Electricity as Fuel for the Annealing of Domestic Glassware."

Chemical Markets

LONDON.—Trade in industrial chemicals, although not particularly brisk, has followed a very steady course during the past week and the movement generally is reported to be satisfactory. A good inquiry is circulating for Solvents and trade for the majority of the Potash and Soda compounds has been on a fair average scale. There have been no important price changes during the week and quotations in nearly all sections of the market are steady with a firm undertone. Rather more interest has been displayed in the Coal Tar products and the volume of inquiry for spot or near delivery transactions shows a definite improvement. There is very little contract business being done, however, and market quotations remain nominal.

MANCHESTER.—Trading conditions on the Manchester chemical market during the past week have been rather quiet so far as actual new buying is concerned, although on the whole contract deliveries have been fairly well maintained at their recent level. With regard to the latter, however, there is still a good deal of room for improvement, especially in bleaching and dyeing materials. For the most part quotations are well held. With regard to the by-products pitch is in slow demand, though a quietly steady business is reported this week in some of the lighter distillates. Little fresh easiness in any direction has occurred.

Company News

Viosulfal, Ltd., have increased their nominal capital by the addition of £30,000, beyond the registered capital of £20,000.

F. W. Hampshire and Co., Ltd., have declared a 30 per cent. dividend, less tax, and a 10 per cent bonus on ordinary and "A" ordinary shares for the year (same).

The International Nickel Co. of Canada, Ltd., have declared a quarterly dividend of 50 cents per share of common stock, payable March 31. In each quarter of 1938 50 cents per share was paid.

Blundell, Spence and Co., Ltd., report a fall in profits, from £37,171 to £18,149, for the year ended October 31. The ordinary dividend is reduced to 2½ per cent. (6 per cent.), and £7,277 (£10,322) carried forward.

The Gas Light and Coke Co. accounts for 1938 show an increase of £887 in net revenue to £13,573,409 to £13,650,297. Revenue from gas sales was slightly lower at £8,808,386 (£8,825,575). Manufacturing costs are reduced from £5,919,440 to £5,792,754, but £4,267,059 (£3,816,700) was absorbed by distribution.

The South Metropolitan Gas Co. report for 1938 an increase of £887 in net revenue to £561,136. Income from the sale of gas fell from £2,672,544 to £2,642,871, and income from the sale of products declined by £41,402 to £775,395. There was a reduction of 3.46 per cent. in the quantity of gas sold, but sales of gas for industry again increased.

Borax Consolidated, Ltd., have declared a dividend of 7½ per cent., less tax, on the deferred ordinary stock for the year to September 30 last, the same rate as was paid in the two previous years. In addition a bonus of 2½ per cent. was paid last year. The final dividend of 3 per cent. on the preferred ordinary stock, now declared, brings the distribution up to the full 6 per cent. Total net profits for the year amounted to £405,284 (£486,232).

